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Volume 5/Number 6

June 1984

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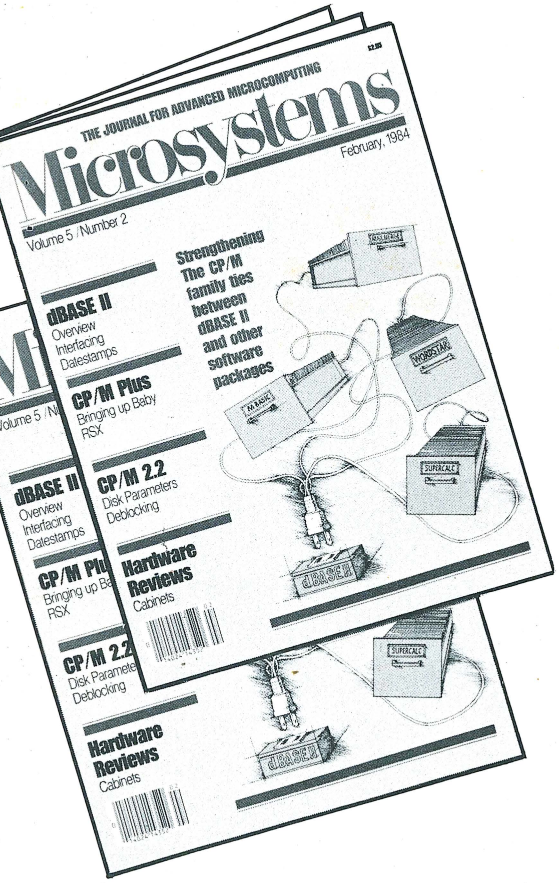
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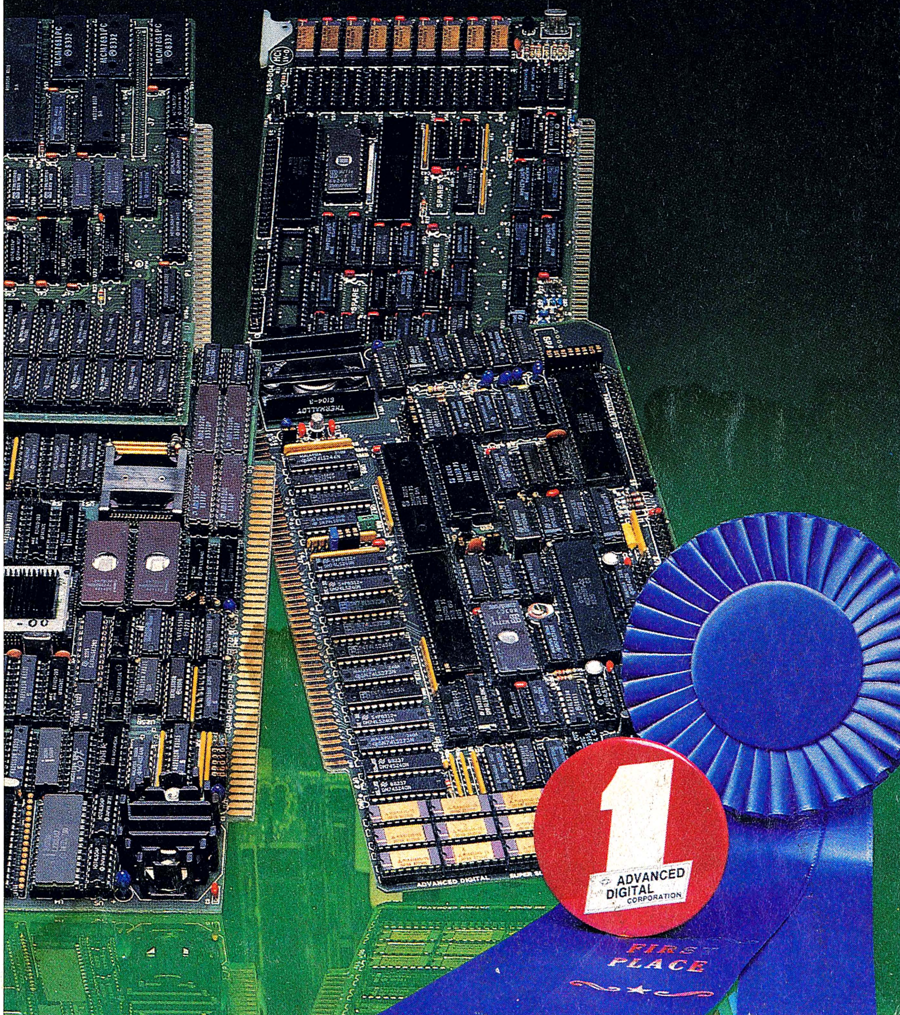

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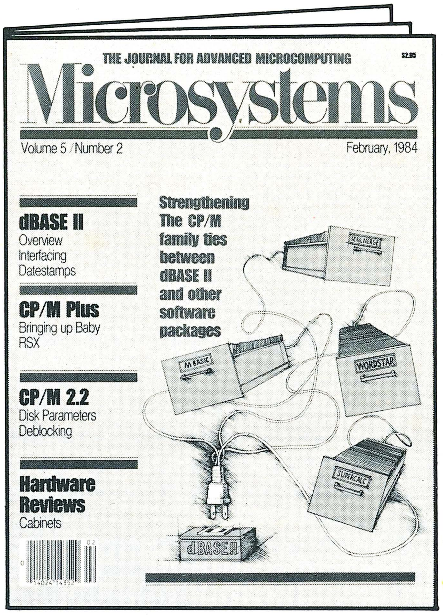
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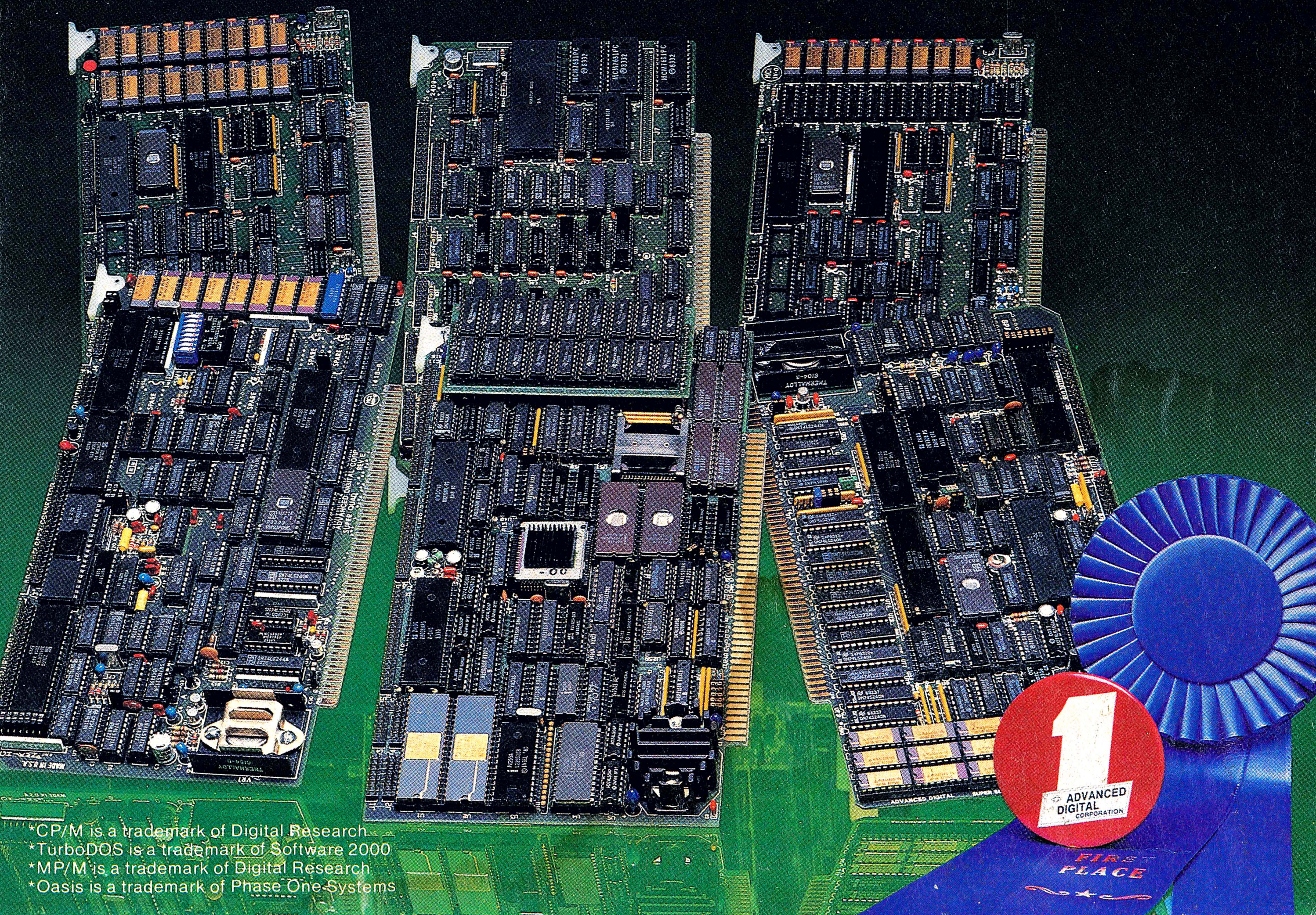

(Top row L to R: Super Slave 128, HDC-1001, Super Slave 64, Bottom row L to R: Super Quad, Super 186, Super Six)

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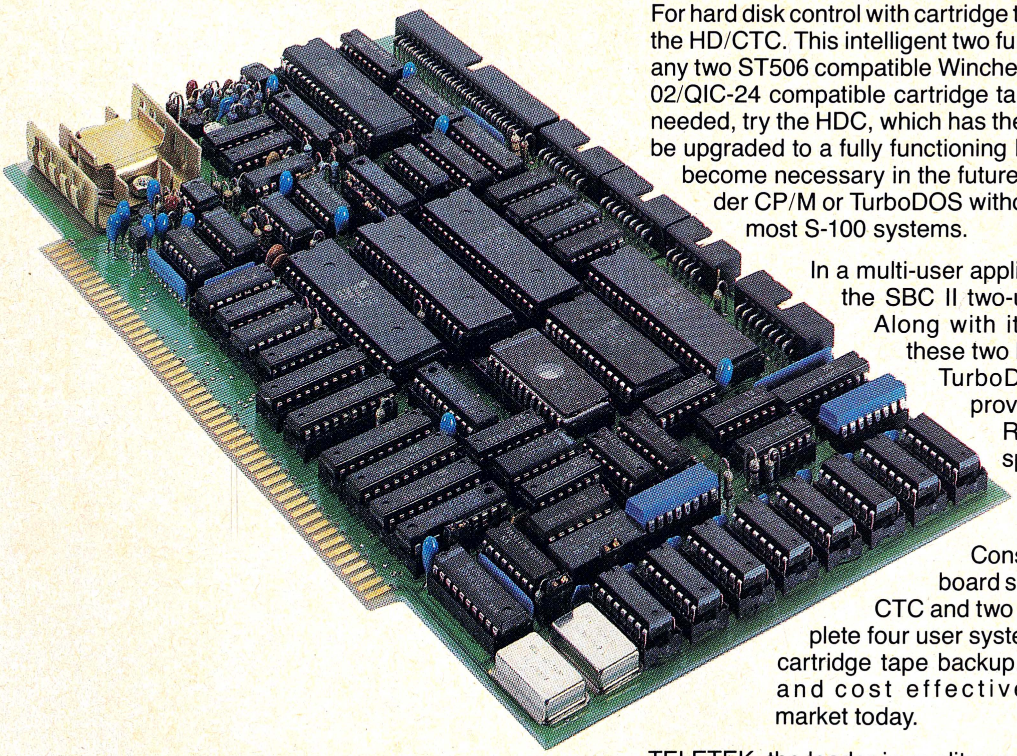

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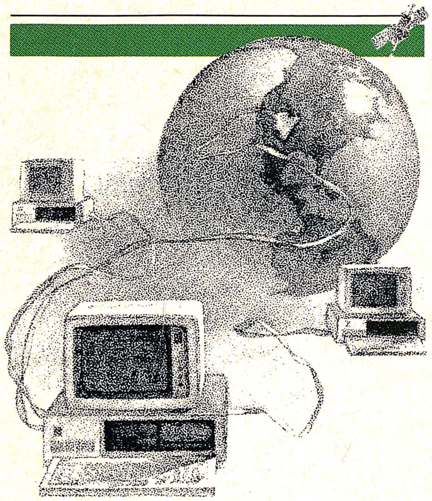

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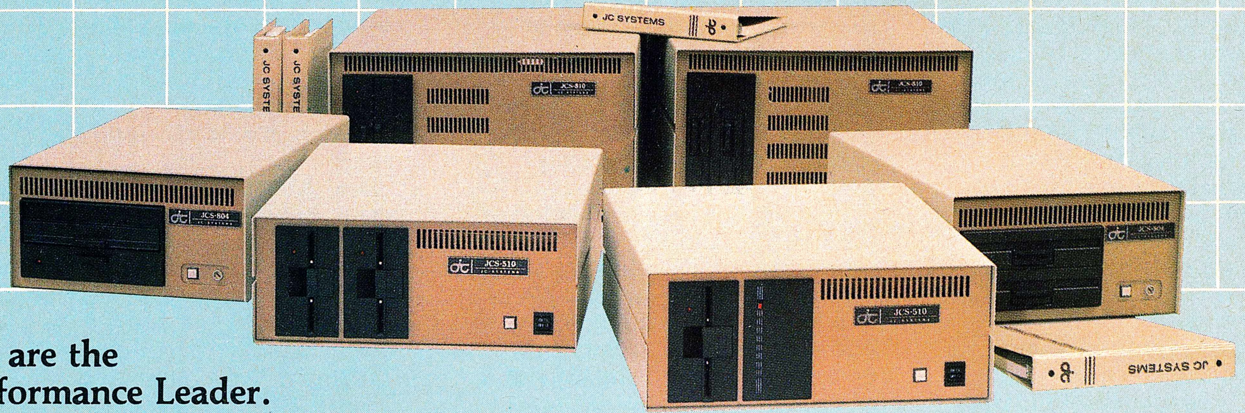

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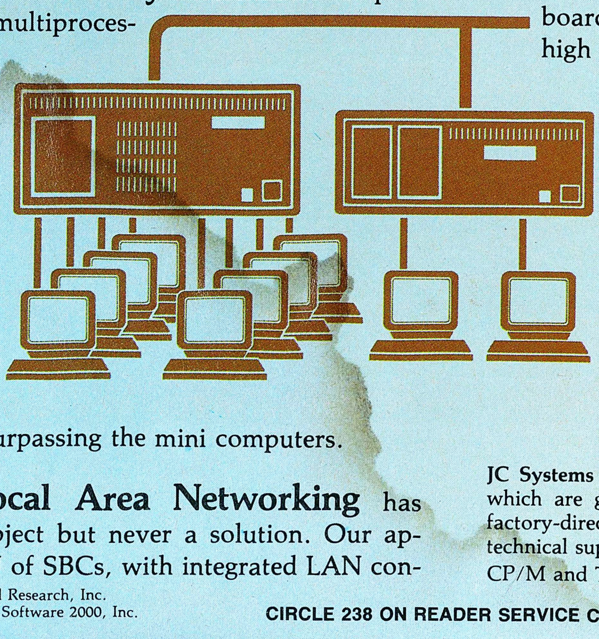

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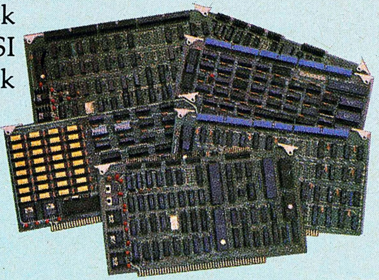

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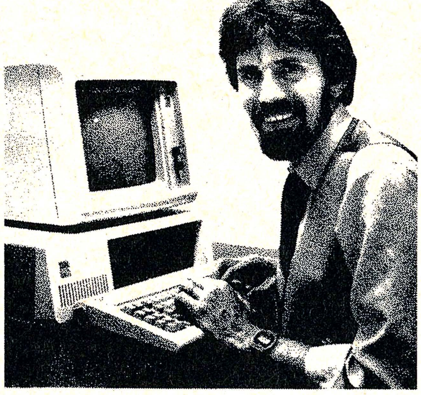
Editor's Page



Lack of programming interface threatens software usefulness

by Mark Rollins

When microcomputers broke onto the scene in the early-to-mid seventies, they spoke only to themselves, and then in a much more limited way than the powerful micros and supermicros do today. As micros were developed and new uses found for them, there also developed a new breed of individual to work on them: the inimitable hacker, or guru.

That individual both programmed the machine and ran it, even when there was a client involved. Inside the micro community, there was a close-knit feeling between programmer and vendor. For the vendor, the programmer *was* the end-user. Outside the community, a perception, nay, more of a legend, developed about programmers: micros were relegated to dark corners of the basement, and the so-called "mushroom theory" of motivation (and pay) could be used when dealing with them. After all, they were compulsive and self-isolated. Why feed them more than mushrooms?

Now that the rest of the world seems to be waking up to the potential power of micros, one of the current explosions of interest lies in getting micros to communicate with other micros and with mainframes. Networking and communications are among the latest buzzwords.

With this issue, we take a look at micros coming out of the basement and plugging into the rest of the world. We examine protocols, file transfers, and terminal emulation. We look at some of the problems involved with micro communications, and we offer some solutions.

Before getting to the issue itself, I'd like to comment about a trend that seems to be emerging which poses a threat to the long-term stability of the micro industry. This trend has to do with many vendors' growing perception of what an end user is and, consequently, who their customers are.

As micros penetrate wider markets, there are more and more end users who know little, and care less, about the *internal* workings of the software they are buying. On the other hand, as soon as they get their hands on a package that does something they want, they seem to develop an insatiable appetite for more. "Since it can do this, can you make it do that?" is a request often heard by custom programmers.

Now, there are certainly more non-programmer end users than there are programmers, and the vendors are quite reasonably turning their attention to that segment of the client base. However, they are doing so with an almost *total disregard* for systems developers and custom software programmers.

I can probably best summarize the symptoms of this trend with the following observation: at a recent computer conference, I noticed, amidst the mass of vendors and software products, a preponderance of database and information management systems, *not a single one of which had a programming interface.*

By not having such a programming interface, it becomes impossible to provide end users with the add-ons and extensions they increasingly demand. Now, although it can be argued that a clever programmer can get a good information management system to do almost any processing required, the point is exactly that: it takes a clever programmer to do it.

Clearly, the customer target for the vendors of these products *is* the Fortune 1000 end user who has little, if any, programming experience. That seems to be where the vendors perceive the big dollars really are in software sales.

The problem is, that perception threatens to choke the industry in the long run. By catering to the relatively inexperienced end-user, and ignoring both the systems developer and the ability to write custom programs, the problem of systems existing in a vacuum, of not being able to talk to each other and work together, is just going to be exacerbated. And that clearly is at odds with the interests of those same Fortune 1000 managers, as evidenced in their cries for more networking capabilities and program portability.

It would seem time for the vendors to wake up to the fact that, while they may be going after the immediate big-dollar profit, they are in fact creating an environment in which their future profits will be threatened by the constraints built into their software products.

This can be likened to the situation which exists in such places as Wall Street and the Department of Defence, where languages such as Fortran and Cobol have been used to create massive software systems. With modern languages, those systems have become antiquated and unwieldy. Yet it is not economically feasible to upgrade them because of the massive expense required to do so.

If the vendors (and this applies to *all* vendors, not just database and information system vendors) don't wake up and remedy the situation, then history will once again threaten to repeat itself.

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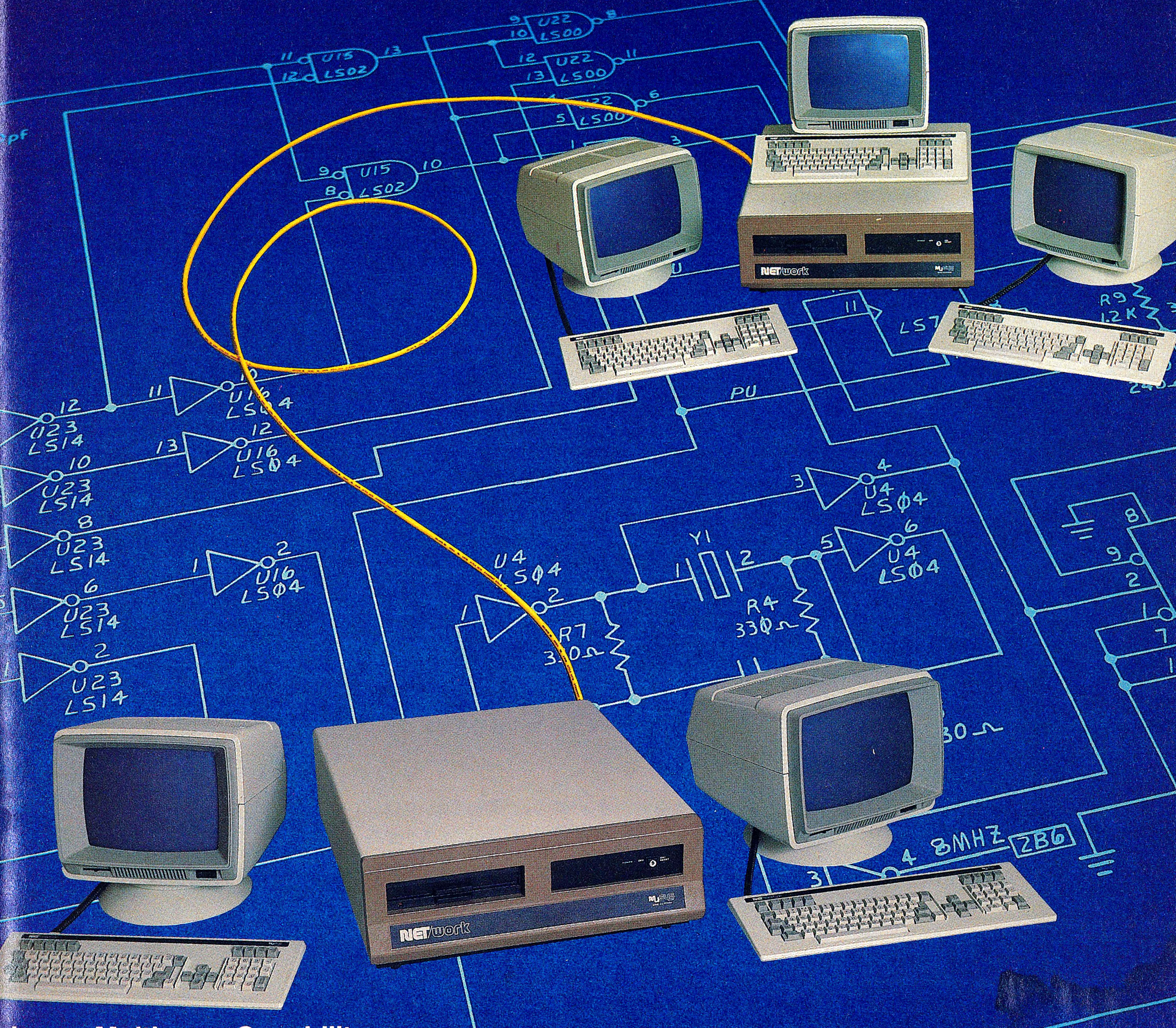

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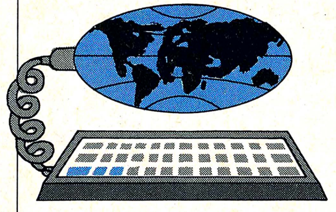

News & Views

Random rumors and gossip, plus a view of the industry's latest trends

by Sol Libes

KayPro is rumored to be arranging the distribution of a new battery-operated portable system, made for them in Japan . . . . Hewlett-Packard is said to be readying a business-oriented 68000 machine running both UNIX and HP's own operating system . . . . IBM is expected to introduce version 3.0 of PC-DOS this summer. It should feature multitasking, windows and some networking support. The biggest surprise about 3.0 is that IBM reportedly developed the system themselves after having Microsoft develop the previous versions. This will no doubt cause problems for IBM PC-compatible system manufacturers . . . . Microsoft is rumored to be readying a business software package for the PC (General Ledger, etc.).

Pick System is finally expected to release a version of its PICK operating system for the IBM-XT that will be marketed by IBM. PICK, which was developed in 1973, has been implemented on over 20 different minicomputer systems and has proven itself a very popular multiuser, multitasking operating system.

IBM is understood to have formed a task force with the specific objective of developing compatibility of the file systems used on the PC, System/38 and 4300/308X computer families.

Commodore is said to be negotiating with Intel for a manufacturing license for the 8088 microprocessor IC for an IBM PC-compatible system they are expected to introduce late this year. Commodore recently signed an agreement with Bytec-Comterm in Montreal, Canada for use of their Hyperion system design.

Public domain software news

The C Users' Group has released four new volumes of C software. They include: 1) an 8080 assembler in C and a file copy utility; 2) 6809 tools including a C compiler and graphics systems for the Radio Shack Color Computer; 3) full-screen editor written in C and text utilities; 4) BDS-C compiler utilities and extensions. The Group publishes a quarterly newsletter ($10/six issues). Contact: **C Users' Group, Inc.,** *Box 287, Yates Center, KS 66783* or phone *(316) 625-3554* (9 a.m. to noon CST).

SIG/M (Special Interest Group for Microcomputers, Amateur Computer Group of New Jersey, Inc.) has issued five new volumes of public domain software, which brings their total up to 162. The new volumes contain the following:

Vol.	Description
158	YAM—Yet Another Modem for CP/86
159	TINCMP macroprocessor & META compiler for CP/M-86
160	Time stamp, extended erase, .PRN cross reference programs & Apple programs
161	Miscellaneous utility programs
162	Concurrent Pascal-S & Wirth PL/O compilers

For complete SIG/M software information send $2.50 ($4 foreign) for printed catalog to: **SIG/M,** *Box 2085, 177 Hadley Ave., Clifton, NJ 07015-2085* or call: Bill Chin *(201) 778-5140.*

The PC-BLUE User Group has issued five more volumes of software for PC/MS-DOS systems. So far, they have released 49 volumes. The most recent of these are available on double-sided format and contain up to 320K of programs.

The new volumes are:

Vol.	Description
46	Asychronous communications program & PC-File Version III
47	Encipher, screen control, graphics, spooler and other utilities
48	Stock Portfolio Valuation System, Graphic draw, Hi-Res screen print, spooler and System configure programs
49	Updated Remote Bulletin Board System programs

UNIX news

AT&T has finally introduced its first line of computers, consisting of machines and workstations based on their own 32-bit microprocessor, the WE-32000. The new computers will all use UNIX System 5 and will feature 256K memory chips (see article elsewhere in this issue).

The largest system, the 3B20, is architecturally comparable to the DEC VAX-780 and the IBM 4361, and will accommodate an unlimited number of users. The system has been released in three versions—models S, A, and D—which range in price from $230,000 to $340,000.

AT&T also unveiled a smaller multiuser system and a middle-range system. The smaller system, the 3B2, will support up to 18 users and is similar in design to the advanced IBM PC and the VAX 730. It will sell for $9,950. The middle-range system, called the 3B5, is comparable to the VAX 750 and the

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NEWS & VIEWS

Continued from page 10

IBM System 38, and is offered in two models. The 3B5 100 will allow up to 30 users, while the 3B5 200 will allow as many as 60. They are priced at $57,000 and $73,000, respectively.

Two other products were introduced to support the new AT&T line. The *3BNET* provides Ethernet-compatible interfaces for the 3B line. The *PC Interface* provides both hardware and software for the interconnection of the 3B2 with personal computers.

AT&T will sell all the systems through value-added dealers, as well as through their own direct sales force and OEMs such as the spin-off phone companies.

IBM releases XENIX for system 9000

IBM has begun shipping the XENIX operating system for its S9000, 68000-based series of desktop computer systems six months after it was announced. XENIX is the Microsoft implementation of UNIX Version 7 for microcomputers. The S9000 microcomputer systems are made and marketed by the IBM Instrument Division. Using XENIX, the S9000 can handle up to four users with full multitasking ability. A basic S9000 system starts at $6,495. With a 10MB hard disk, floppy disk, 640K of RAM, and memory management, the price is $15,960.

The S9000 series (which comes in two flavors, the S9001 and S9002) has been revamped. It has gotten a facelift to make it look more attractive. First introduced strictly as a laboratory scientific computer, it has undergone a metamorphosis into a general-purpose machine. Although still being marketed primarily as an engineer's and scientist's machine, it is now becoming very attractive as business multiuser system. For example, when running under XENIX, the system features a full-screen editor, spelling checker, text process or, typesetter formatting, bibliography generator, electronic mail, a calendar reminder service, and on-line tutorials. IBM has also begun selling two business-oriented applications packages from Ryan-McFarland.

The S9000 systems with XENIX thus appear to be competitors of the IBM-XT with IBM's new PC/IX operating system. PC/IX, discussed in last month's column, is a single-user version of UNIX System III. A four-user S9000 system looks like it will cost significantly less than four XTs running PC/IX and will be considerably more powerful and user friendly. Further, there is a distinct lack of compatibility between the systems. The S9000 is also expected to present competition to the new 80286-based multiuser, multiprocessing system that the IBM Entry Systems division is expected to introduce later this year. To add to IBM's confusing UNIX-marketing situation is the shipping of the Berkeley version of UNIX on the XT to MIT (see story below). It will be interesting to see how IBM does in competing with itself!

IBM ships XTs with 16032 coprocessors

IBM will soon be shipping 150 XTs, containing plug-in CPU cards equipped with the National Semiconductor 16032 16-bit microprocessor to Massachusetts Institute of Technology for use on their large networking development project (described previously in this column). The boards are made by Sritek and include the National Semiconductor floating point math coprocessor ICs. IBM will also provide its new video controller board with high-density graphics capability. The systems will be provided with the Berkeley version of UNIX.

> **The IBM S9000 series has undergone a metamorphosis into a general-purpose system.**

The 16032 is a 32-bit microprocessor with 16-bit I/O, clocked at 10 MHz. It supports a demand-paged virtual-memory environment similar to the DEC VAX.

The networking research project, funded by Digital Equipment Corp. ($40 million), IBM ($10 million) and MIT ($12 million), is expected, within 5 years, to tie together 6,000 personal computers, 63 DEC VAX minicomputers, and 150 DEC VAX microcomputers. All the systems will run various versions of UNIX. It is expected that most of the personal computer workstations will be Sun Microsystems and new DEC units similar to the Sun systems. MIT is expected to develop an enhanced version of UNIX (which was designed only to be a multiuser timesharing system) to operate in a shared-resource network environment with enhanced graphics user interfaces utilizing windows and mice. It will probably come to be known as the MIT version of UNIX.

AMI releases specs on CP/M microchip

American Microsystems, Inc., of Santa Clara, CA has released the specs on its Z80 microprocessor which includes "Personal CP/M" in an 8K ROM. Called the "S83," the 48-pin chip provides all the basic control, address and data signals and instructions of the Z80. The internal ROM is enabled or disabled via software to give the user access either to the Z80 instruction set or to the Personal CP/M code. The chip has an improved dynamic RAM interface so that it can drive 64K of dynamic RAM directly, which accounts for the additional 8 pins on the chip. AMI expects to furnish other versions of the chip with other software in ROM, and thus the S83 is the first of a family of microprocessors. AMI claims to already be sampling the chip; volume production is expected this fall. The price is $32 in 1,000-unit quantities.

32-bit microprocessor IC news

AT&T Technology has announced that it will shortly start selling a 32-bit microprocessor chip called the 32100. Housed in a 132-pin package, it claims to be the first 32-bitter with completely separate full-width data and address paths providing the highest system performance and speed. The chip can drive the data bus directly without requiring buffers and line drivers.

The ALU, registers and ROM are the same as the company's first 32-bit microprocessor, the BellMac-32. It has a 64-word cache circuit so that instructions can be fetched and executed at the same time. The chip also provides the interface signals for several coprocessors now in development.

Companion chips will include a memory management unit to handle up to 4 gigabytes of virtual memory. Paged and variable-length contiguous segment translations are possible to allow for protection of software by page or segment. Demand-paged restartable memory is also possible. The chip is fabricated in CMOS, clocked at 14 MHz and dissipates only 1.9W.

Motorola is expected to finally begin sampling its true 32-bit microprocessor chip, the 68020, and Intel hopes to begin sampling its 80386 chip before year-end. Both parts will be in CMOS because the manufacturers have been unable to overcome heat dissipation

Gifford has a lock on multiuser CP/M® 8-16.

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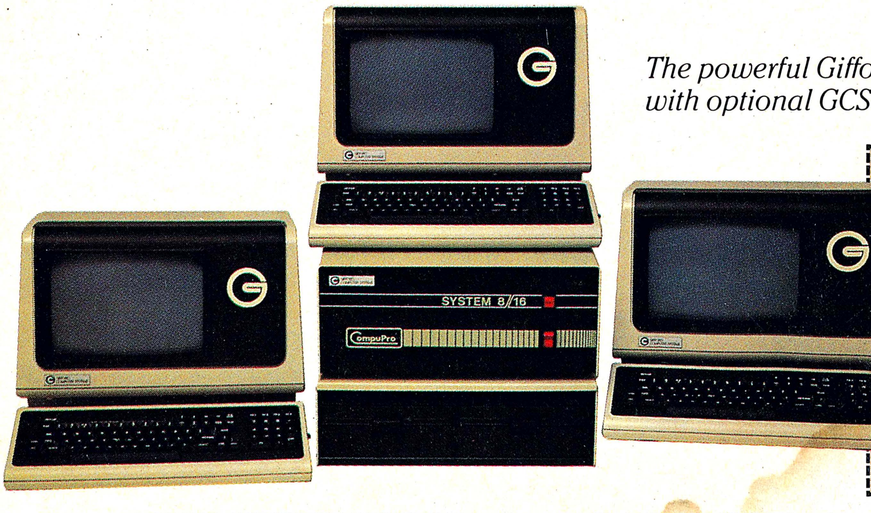

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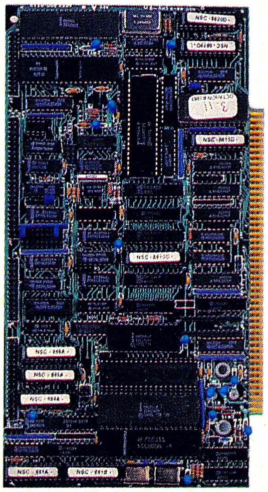

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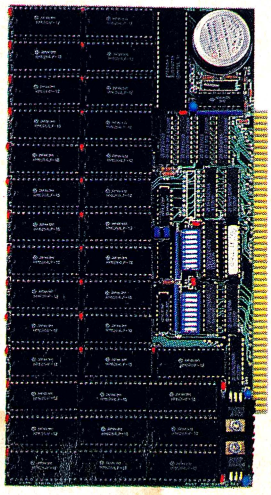

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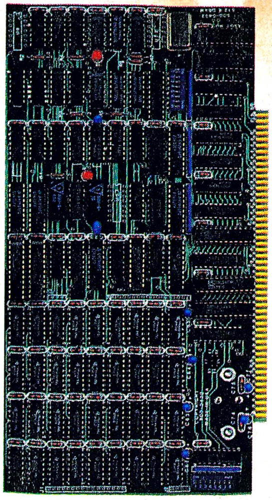

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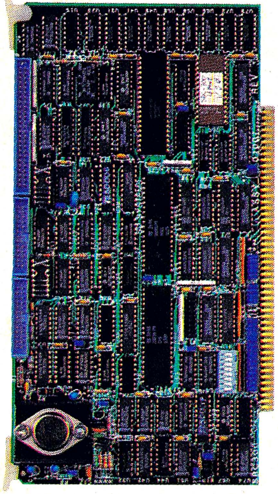

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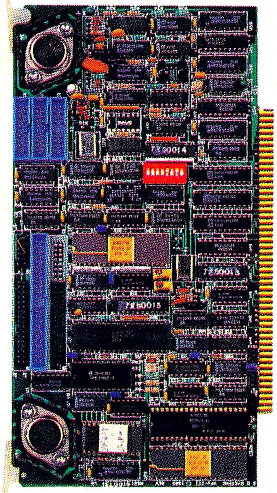

5 VFW-III

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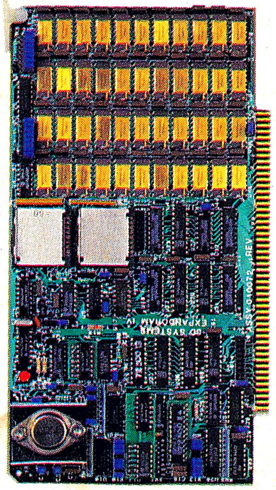
- IEEE-696/S-100 compatible.
- $895 (Manual only: $25)



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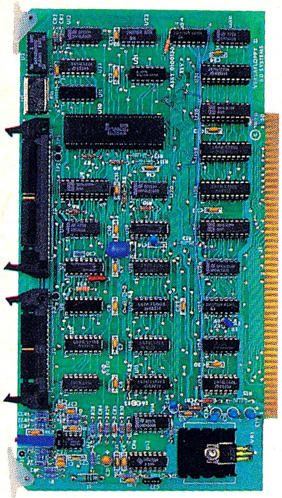

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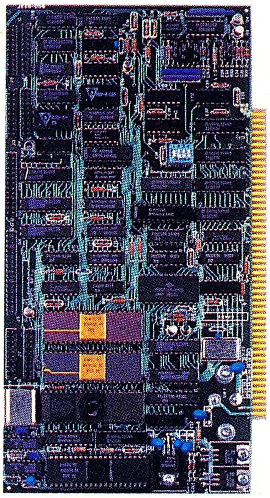

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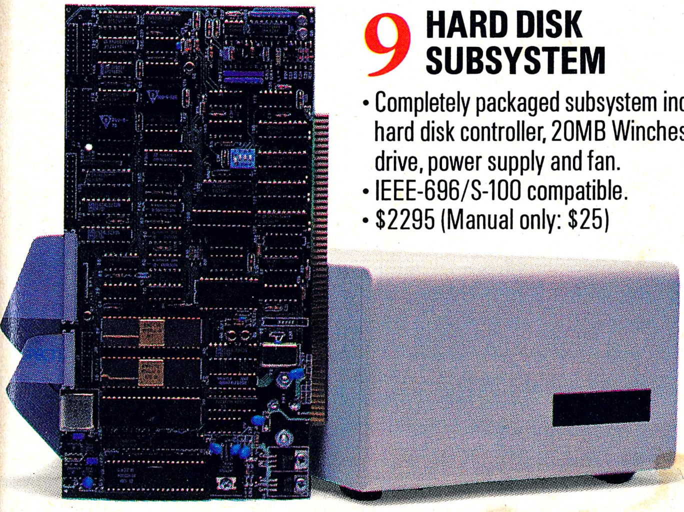

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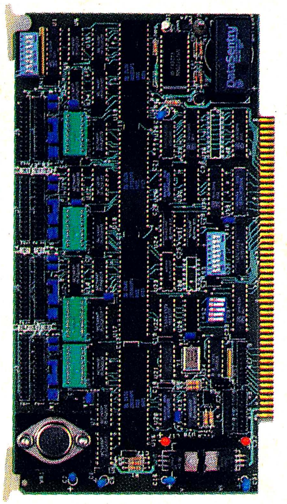

10 I/O 8

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NEWS & VIEWS

Continued from page 13

problems encountered with NMOS technology. National Semiconductor, who late last year began sampling their NMOS 32032 32-bitter (a bus extension of their 16032), is known to be developing a 32132 high-end 32-bit chip also using CMOS, with sampling expected very late next year.

The Software Protection Fund has been formed to combat software piracy.

Zilog is expected to begin sampling its NMOS Z80,000 late this year.

Motorola has indicated that the 68020 will contain 200,000 transistors, and the Intel 30386 is expected to have a comparable number. Intel's 80286, their most sophisticated 16-bitter, contains 130,000 devices, and the National Semiconductor 32032 contains 70,000. National's 32132 is expected to contain between 400,000 and 500,000 transistors. Zilog has stated that their Z80,000 will contain "well over 100,000 transistors."

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The following three new user groups have free membership and hold monthly meetings. For information send a stamped self-addressed envelope or call the number listed.

Central Mass CP/M Users Group, c/o Brother Jim Smith, *Saint John's High School, 378 Main St., Shrewsbury, MA 01545, (617) 845-1878.*

Napa Valley CP/M Users Group, *Box 4096, Napa CA 94558. RBBS/RCPM (707) 257-6502.*

dBASE II User Group/Silicon Valley, c/o Melissa Gray, *Box 190, Mountain View, CA 94042-0190.*

Anti-software piracy fund formed

The **Software Protection Fund** has been formed to aid in the combating of an explosion of illegal software copying. The SPF's goal is to frustrate software piracy, particularly by large companies or "national account" users, professional resellers, home users and hobbyists, software rental firms, and companies that "aid and abet" by marketing software copying devices and software.

The SPF organizers include Ashton-Tate, Lotus Development Corp., Sorcim and Microsoft Corp. The group, which already has $500,000 in contributions, expects to work closely with ADAPSO (Association of Data Processing Service Organizations) to influence government copyright-law legislation. It will also "educate" to discourage copying and pursue enforcement of legal rights against pirates.

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S-100 news

International Data Corp. (IDC), a Framingham, MA. market research company, has issued a study of the S-100 computer market. IDC predicts that the S-100 business will increase by 40% this year and that S-100 board makers will ship 227,000 boards, up from 162,000 last year. They further predict that the S-100 market will peak within a few years.

In the report they contend that CompuPro owns 63.3% of the worldwide S-100-based CPU board business and that about half of CompuPro's sales are to OEMs and system integrators.

Random news

Buzzwords, Inc. *(25 Van Zant St., Norwalk, CT 06855; (203) 853-6880),* has released a translator program called M2CBasic which converts Microsoft's Basic source code programs into compiled Digital Research CBasic code. Versions are available for all versions of CP/M and PC/MS-DOS. . . . Morrow, Inc., has published a 61-page book that answers the 90 most frequently asked questions regarding their Micro Decision personal computer. Owners of Morrow Micro Decisions and people considering the purchase of a Morrow Micro Decision will find it of great value. To get a free copy, write to **Morrow, Inc.,** *600 McCormick Street, San Leandro, CA 94577,* and ask for the *Micro Decision Question & Answer Book.* It was interesting, however, that, in the preliminary copy of the book that I received, three of the questions did not have any answers.

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Omission in May issue

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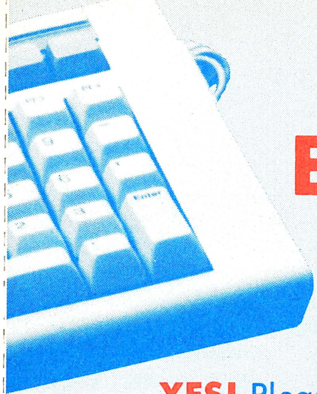
Readers may contact me directly at Box 1192, Mountainside, NJ 07092. If a response is desired, enclose a stamped self-addressed envelope.—Sol Libes



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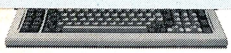

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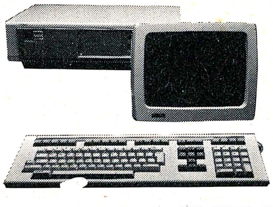

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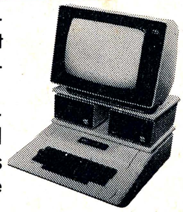

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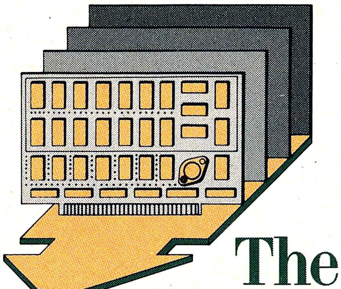


The S-100 Bus

S-100 interrupts, clock signals, realtime clocks and power requirements

by Dave Hardy

This month, instead of discussing just one or two subjects, I'd like to briefly cover several things that I'm frequently asked about in letters from readers. These include such subjects as S-100 interrupts, clock signals, realtime clocks, and S-100 power interrupts.

Not NOT

Many readers seem to be confused by the use of the "*" in the IEEE-696 standard. In general, "*" is used to mean "active low," and it replaces the overbar (logical NOT) symbol. As far as I know, this was done just to make the notation easier to enter into a word processor. Most word processing machines don't have an overbar character, but virtually all have an "*" character. So, it was decided to replace the overbar with an "*" suffix. For example, the signal ZOT is meant to be active high, and the signal ZOT* (read "ZOT star") is meant to be active low.

S-100 interrupts

The IEEE-696 bus defines only two interrupt lines, INT* (the S-100 bus's primary interrupt-request line, pin 73) and NMI* (the nonmaskable interrupt-request line, pin 12). Both lines are to be controlled by open-collector drivers and are pulled up to a logic one by resistors (1000 ohms). Except for these similarities, and the fact that both lines are used to request service from the permanent bus master, these two signals have little else in common.

The INT* line is a maskable interrupt to the bus master processor. In other words, the processor can be made to ignore this interrupt, usually with a simple command or hardware operation. On most Z80 boards, for example, the DI instruction can be used to disable all interrupts from the INT* line, and the EI instruction can be used to enable them. Because the INT* signal is asserted as a LEVEL (low true), the master processor may respond, upon receiving an interrupt request from the INT* line, with an interrupt-acknowledge bus cycle to allow other devices to place additional vectoring information onto the data bus. Afterwards, the INT* line is returned to its inactive (high) state. In addition, the INT* line may also be used in conjunction with the eight vectored interrupt bus lines (VI0*-VI8*) to allow up to eight levels of prioritized interrupts. With additional hardware on S-100 boards, the INT* line can be used for very complex interrupt structures.

In contrast to the INT* line, the NMI* line is not maskable (i.e., the master processor can't turn it off or ignore it). Also, NMI* is asserted as a negative-going EDGE, not as a level, like INT*. Because NMI* is edge triggered, no interrupt-acknowledge bus cycle is generated by the master processor, so it is not frequently used in complex interrupt schemes. Since it can't be easily masked from software, NMI* is used almost invariably for system reset or power failure sensing.

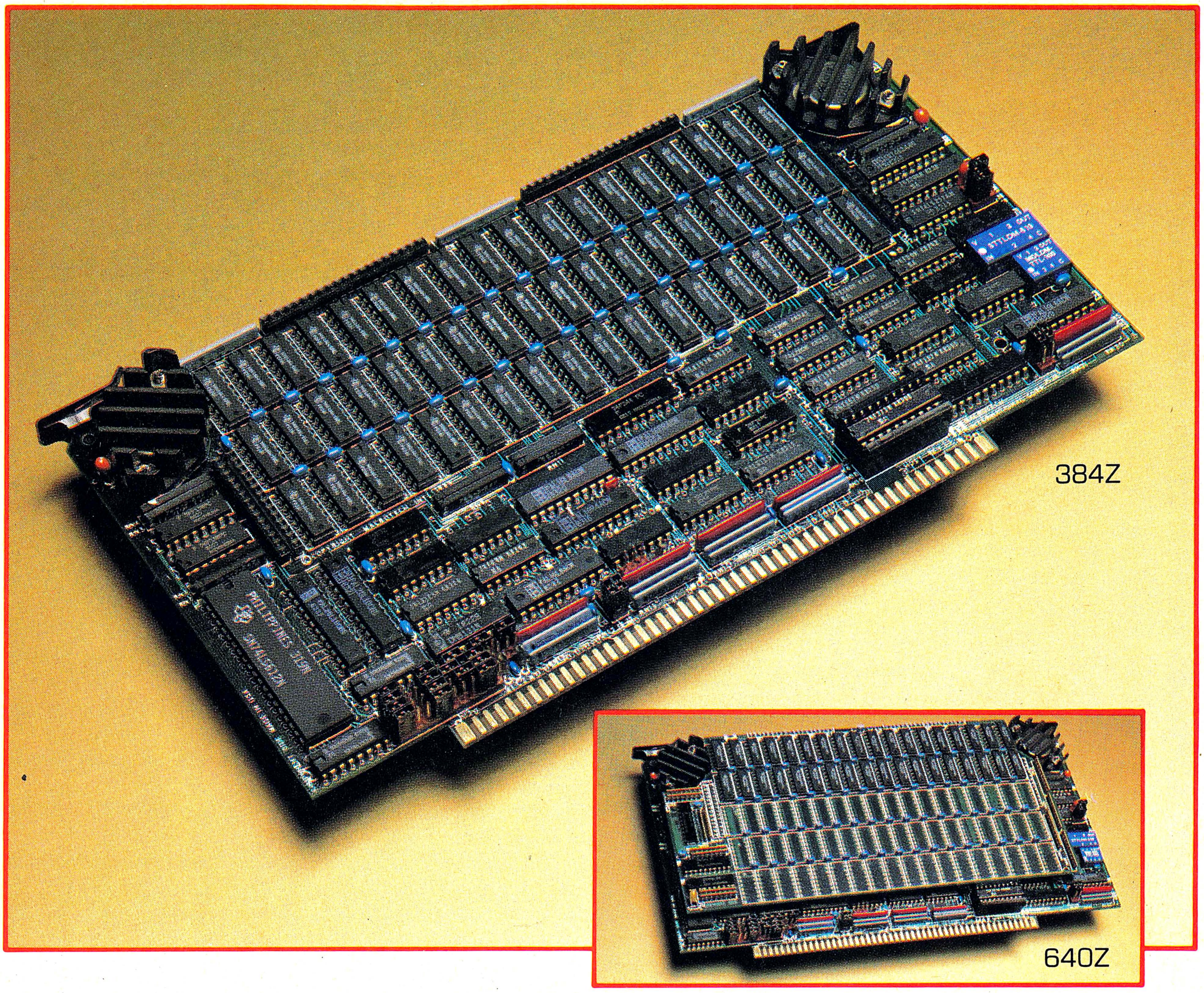
Two other lines that are sometimes thought of as interrupt lines (but actually are not) are PWRFAIL* and ERROR*. PWRFAIL* is used to indicate that power failure to the S-100 frame is imminent. By IEEE-696 specification, PWRFAIL* must be asserted at least 50 msec before S-100 board regulators can drift out of specification, and should remain active until power is fully restored, and POC* (pin 99) is true.

ERROR* is a "generalized" error line that can be used to indicate that the current bus cycle operation is causing some kind of error. The IEEE-696 specification does not specify what kind of errors should cause ERROR* to be asserted. Instead, it leaves this up to the board designers, which is a wise choice. The specification does, however, recommend that ERROR* be implemented as a "trap," and it further recommends that all relevant information about the current bus cycle should be latched somewhere on the falling edge of ERROR* (that is, just as ERROR* becomes active).

Both PWRFAIL* and ERROR* are defined as open-collector lines. Use of these lines is optional, which is good, since *very* few boards actually use them, and also because the IEEE-696 standard specifies how these lines are to be asserted, but not what they are to control (this, again, is left up to the board designers).

System clock vs. CLOCK

The IEEE-696 bus allows for two clock signals: ϕ (pin 24), the master timing signal for the bus, and CLOCK (pin 49), a simple 2 MHz signal. The master timing signal (commonly called the system clock) must be generated by the permanent master processor and is used to control timing for all bus cycles, even those which originate from other (slave) processors. CLOCK is just a 2 MHz signal (0.5% tolerance) that is made available on the bus for the use of peripheral devices like timers, baud rate generators, time-of-day clocks, etc. It is a common fallacy that CLOCK must be derived from, or somehow related to or synchronized with the system clock. Al-



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S-100 BUS

Continued from page 18

though some currently available (improperly designed) S-100 boards may require this, the IEEE-696 standard specifically states that CLOCK need not have *any* relationship to *any* other bus sigal. This is a convenient regulation that I have used myself to let me place an extremely accurate (0.001 ppm) timing signal onto the S-100 bus for use in a frequency-measuring device and various other types of instrumentation.

Realtime clock

Although this is not solely related to the S-100 bus, it is still worth mentioning. A realtime clock is just a circuit that keeps track of *real* time, like an alarm clock or an egg timer. Probably the simplest case of a realtime clock is a simple interval timer. Thus a circuit that generates an interrupt every millisecond can be called a realtime clock, as can a Mountain Hardware 100,000-day clock board, a signal generated from the AC power line, or even the index signal of a floppy disk drive (as long as the disk is spinning), because all keep track of *real* time. A timer implemented in hardware can usually be considered a realtime clock. A timer implemented in software, however, may or may not be realtime, since the execution time of the software timing-loops may vary, depending on system clock speed, coding and whether or not the system uses interrupts. For example, you could implement a realtime clock in software in a simple, noninterrupt-driven CP/M system, but you could not implement a realtime clock in software in an interrupt-driven MP/M system because interrupt servicing would cause the realtime clock to be inaccurate.

When many systems manufacturers say in their advertisements that their systems have a realtime clock, they really mean that their systems have programmable interval timers that can be used to accurately keep track of realtime. These devices usually work well, except that they require a bit of software overhead to calculate the actual time and date from the time interval measured in the counters. Some of the less expensive counter/timer circuits are subject to error when interrupts are used. However, many manufacturers are now using special clock/calendar ICs that eliminate all major sources of error and are as accurate as their crystal timebases, often with errors as little as a few seconds per month.

DMA vs. TMA

DMA (Direct Memory Access) is the process by which a temporary master takes control of the bus to perform one or more memory cycles (usually to transfer data into or out of RAM). In the IEEE-696 bus, a temporary master may take control of the bus for *any* bus cycle (not just memory bus cycles), so the process was renamed TMA (Temporary Master Access) to more properly describe the transfer process.

S-100 power requirements

One of the key features of the S-100 bus is its local power regulation on each board. This feature eliminates the need for expensive, highly regulated power supplies while simultaneously reducing noise propagation via each board's power lines. Because each board has its own power regulators, exact input voltage to the boards is unnecessary. Actually, any input voltage is acceptable, as long as it is high enough to be regulated (the regulator ICs are generally rather inefficient and have an internal voltage drop) but low enough to avoid excessive heat dissipation and component breakdown. Regulator ICs, like the LM309 series commonly used to provide the 5V needed for TTL, generally regulate incoming power by dissipating excess input power in the form of heat. Thus it is important to keep the input voltage as low as possible to avoid excess heating, but high enough to let the regulator function.

The three main power supply lines in the S-100 bus are generally said to be +8V, +16V, and -16V. As stated in the IEEE-696 specification, the +8V supply should have an instantaneous minimum value of +7V, an instantaneous maximum value of +25V, and an average maximum value of +11V. Similarly, the +16V supply's values should be +14.5V, +35V, and +21.5V, and the -16V supply's values should be -14.5V, -35V, and -21.5V.

S-100 vs. IEEE-696

As you may have noticed, throughout my column I use the terms "S-100 bus" and "IEEE-696" bus almost interchangeably. Although there can be quite a difference, the term "S-100" will probably always be the common name for this particular bus configuration. The bus was originally called "S-100" because it used 100 signal lines, and after being heavily modified by the IEEE as "IEEE Task 696," it was finally called the "IEEE-696" bus. Because of this, all IEEE-696 boards are "S-100," but not all "S-100" boards are IEEE-696: IEEE-696 is a modified superset of the original S-100 design.

Readers are encouraged to send in questions on the S-100 bus. Please write to: Dave Hardy, 736 Notre Dame, Grosse Pointe, MI 48203

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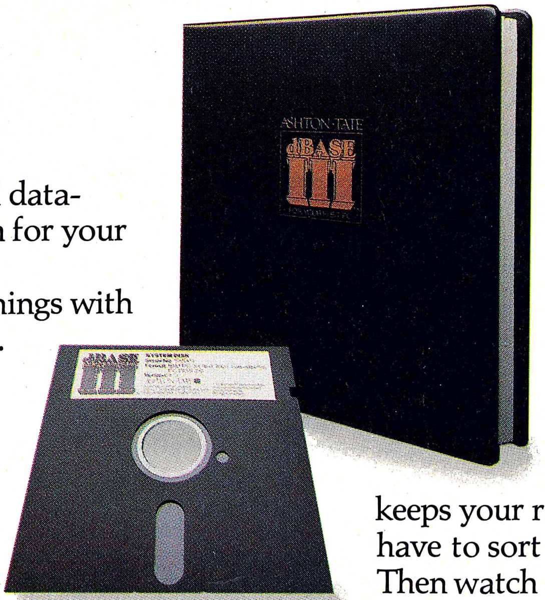

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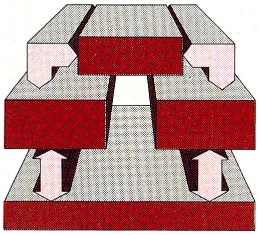

The UNIX File

UNIX for realtime work, using "make," and some UNIX philosophy

by Ian F. Darwin

People who like to repeat cliches often say that UNIX is useless for realtime work. When you ask these people what they mean, they often don't know; it's just something their marketing people said. In fact UNIX can be, has been, and is being used for realtime work.

Realtime work is usually associated with analog-to-digital or digital-to-analog processing. While some A/D or D/A work requires very fast response time from the processor, there is much that does not. Standard UNIX is quite fine for running the lower-end A/D/A work. For larger-volume A/D/A work, or any time where data is being collected at a high rate, UNIX, or indeed any timesharing system, is at a disadvantage. The incoming data interrupts the CPU very often, and the CPU may not be able to respond in time to store all the data, because it also has to service the timesharing users.

There are two approaches to this problem. One is to modify the operating system; the other is to run stand-alone. Digital Equipment's RSX-11 and VAX/VMS operating systems include special provisions for running fast data acquisition processes concurrently with timesharing, and several sites have added this sort of capability to large UNIX systems. On the other hand, a small 68000 or 16032 system will probably not have the throughput to handle both timesharing and a heavy data-acquisition load.

A good approach in this case would be to use all the UNIX development tools to write and debug the program under timesharing, with test input from the file system instead of from the special hardware. Once the program is debugged, you can download the code with a stand-alone runtime system which provides most of the functionality of the UNIX environment. You then upload the data to UNIX for analysis.

One such runtime library is *The C Executive* from **JMI Software Consultants**, *1422 Easton Road, Roslyn PA 19500; (215) 657-5660.* This product runs on a wide range of processors (8080/Z80, 6809, LSI-11, 68000, 16032) and costs a few hundred dollars for the binary kernel and the source to the serial I/O drivers.

Somewhat more expensive is **DNIX**, described as a "UNIX-like realtime operating system" for the 68000 or 16032. Contact **UniVentures**, *27 Buckthorn Way, Suite 1, Menlo Park CA 94025, (415) 325-3283.* UniVentures also has cross-compilers for other micros, as do several other sources (see the April 1984 issue of *Microsystems* for more suppliers).

These approaches allow you to do realtime work (or cross development for other micros) while using all the power and functionality of the UNIX operating system.

Make—an underutilized software tool

Every UNIX system comes with a wide range of powerful software tools. Often the newcomer to UNIX is overwhelmed and needs to be reminded of some of the specialized tools. I'd like to say a few words about one tool, **make**, which is often overlooked by those learning UNIX. The function of **make**, as described in the manual, is to "maintain, update and regenerate groups of programs." However, as is often the case in UNIX, "programs" can include text, actual source programs, data files, and anything else that can be stored in your UNIX files.

Any series of commands that needs to be typed repetitively can be put in a **make** file. I have used **make** to maintain a dictionary, keep a database up to date, apply modifications to a program library, generate a magazine index, and even to build programs as diverse as an adventure game and a syntax checker. And, of course, I use it to manipulate the files used in the preparation of this column.

make is useful any time you have a series of interrelated files. The dependencies among the files, such as which files are included by which others when dealing with a large source-language program, are listed in a "makefile" that you prepare. **make** will automatically recompile only those functions which need to be compiled, based upon the modification dates and times of the files that have been changed.

The simplest form of a rule for **make** is:

```
name: depends-on
      action-to-make-name
```

where "name" is the name of the rule, or the name of the thing to be made; "depends-on" refers to any files on which this rule depends; and "action-to-make-name" is any UNIX command or series of commands needed to make "name." A rule "depends" on a file or another rule if the latter must be up to date in order to build the former, or if the former must be remade whenever it changes.

As an example of using **make** to maintain something other than programs, here is the makefile that I use to prepare this column:

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UNIX FILE

Continued from page 24

```
MAIN = 84-06
PUB  = /usr/pub

column: $(MAIN)
nroff -mu $(MAIN) >$(PUB)/column

binary: $(MAIN)
nrws $(MAIN) >tmp/column

print:  $(PUB)/column
pr -h $(MAIN)$(PUB)/column | 1pr

wc:     $(MAIN)
        deroff $(MAIN) | wc

spell:  $(MAIN)
        spell $(MAIN) | c

clean:
        > $(PUB)/column
```

This declares that the actions I will want to take include making the column itself, making a "binary" (WordStar) format, printing the column, checking the word count, checking the spelling, and cleaning up when done. The "column" rule, which I invoke just by saying:

```
make column
```

runs the **nroff** text formatter on "MAIN" to produce the file /usr/pub/column, which by convention is where I put the column in preparation so that other users on my system can peruse it and offer comments. (The name of the main file is currently 84-06, my coding for June '84. This is the only definition I have to change each month.) Typing "make binary" will form the binary version in WordStar format, using an **nroff**-to-WordStar converter written locally. **make print** will send the output to the line printer, and **make wc** and **make spell** both are used to check up on my work in progress; the former to see if I have gotten carried away again, and the latter to see if I have committed any sins of orthography.

> **No attempt was made to include everything in UNIX—but rather, to keep superfluous garbage out.**

It is customary with **make** to name a rule after its corresponding UNIX command when the rule does not result in the creation of some particular object. **make lint** is common when dealing with C-language program source files to check for programming errors.

make is also useful in maintaining a wide variety of files. At another time I will touch on its use in program development.

Generation gap?

Is there a generation gap between UNIX programmers and developers? My colleague Geoff Collyer thinks that there is. He and I were talking the other day, and the discussion rolled around to those whom we see as butchering UNIX by trying to make it all things to all people. Geoff grew up hacking (a complimentary word until the popular media twisted its meaning) the TOPS-10 operating system, and I cut my eye teeth on IBM's MVT. These are both gigantic operating systems, with hundreds or thousands of modules, complex command languages, volumes and volumes of documentation, extensive on-line HELP facilities—everything that some people want out of an operating system. And yet, these systems are nightmares: impossible to comprehend, impervious to maintenance, hard to use, impossible for the end user to customize.

Eventually we both came across UNIX—he in London, Ontario, and I in Toronto. Each perceived this discovery as an entry into the promised land: a complete operating system which one person could genuinely understand through study of the source code; a clearly defined user interface that was easy for the programmer or the end user to customize; a small and well-specified system call interface to the operating system; good tools for the development of new software, etc. No attempt was made in the early days to include everything in the UNIX operating system. In fact, the attempt was made to keep a lot of superfluous garbage out of the operating system. The UNIX philosophy was to provide as small a set of tools as could be considered reasonably complete, and let people use these tools to build the necessary functions. And it worked very well.

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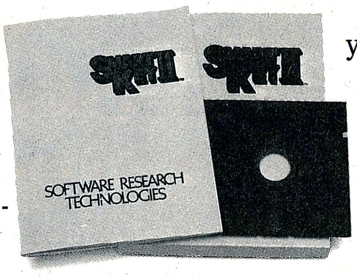

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UNIX FILE

Continued from page 26

But many people, particularly at Berkeley, learn UNIX as their first operating system. Computer science students are always tinkering with systems. When they encounter desirable features in other operating system, they try to apply them to UNIX, without a clear understanding of why UNIX doesn't already have these features, nor, one suspects in some cases, even a clear understanding of why UNIX was successful in the first place.

UNIX survived and prospered throughout the 'seventies—an era of user-hostile operating systems—because it was small, simple, and relatively free of misfeatures. When newcomers start adding unnecesary features to the "kernel," or lowest level of the system, they destroy its elegance.

In 4.1BSD, the UNIX kernel was close to that of the Seventh Edition, although the user-level commands had a large number of differences, such as extra and different options. The generation of computer science student-programmers who developed 4.1 had been exposed to the UNIX philosophy. With 4.2BSD, Berkeley has added to the kernel a new, faster file system. Except for the several serious bugs in the released version (one of which could completely ruin your file system), this is probably a good thing. The changes are transparent to most programs, and a fast file system can significantly improve system performance. *However,* they snuck in a change which is hideously incompatible with the rest of UNIX: Each component of a filename can be up to 255 characters, rather than being limited to 14 characters. Dennis Ritchie of AT&T Bell Laboratories says: "4.2 sins (in the long filename example) by uncomfortable generalization. (An earlier example is long names in C). It is impossible to argue in the abstract that limiting file names to 14 characters or C identifiers to, say, 7 is a good thing. However, it is quite possible to observe that for the part of the world not living with 4.2, it is incredibly difficult to get **tar** tapes with unextractable files" due to the longer filenames.

This is the effect of one apparently small change to the kernel. And suggestions have been made to add almost every expensive, complex feature of the dinosaur operating systems to UNIX. People have called for the addition of record locking to the kernel, arbitrary ENQ/DEQ like that of MVT/MVS, password encryption, runtime libraries, and even (sarcastically) the calculation of the phases of the moon. Yet UNIX is quite capable of doing all these things in user code rather than as system features." The kernel is the only UNIX code that cannot be substituted by a user to his own liking. For this reason, the kernel should make as few real decisions as possible. This does not mean allowing the user a million options to do the same thing. Rather, it means allowing only one way to do one thing, but having that way be the least-common divisor of all the options that might have been provided.

The effects of ill-considered changes to an operating system such as UNIX can be extensive.

"What is or is not implemented in the kernel represents both a great responsibility and a great power. It is a soap-box platform on the 'way things should be done.' Even so, if 'the way' is too radical, no one will follow it. Every important decision was weighed carefully. Throughout, simplicity has been substituted for efficiency. Complex algorithms are used only if their complexity can be localized." So spoke Ken Thompson, the father of UNIX, in a paper called "UNIX Implementation" in the *Bell System Technical Journal,* in 1978. (A copy of this paper is included in Volume 2 of most UNIX manuals. It's in there to be read.) That's not to say that everything done by 1978 was perfect—there still remain design limitations. But it is to say that one should not put every imaginable chunk of code into the kernel.

The effects of ill-considered changes to an operating system such as UNIX can be extensive. Among the most serious is that programs, programmers and data are no longer portable across versions of the system. Ritchie

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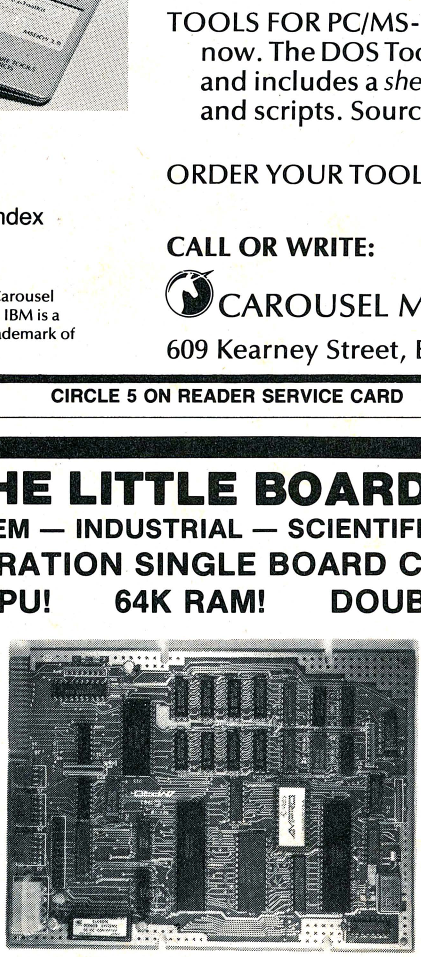

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CIRCLE 65 ON READER SERVICE CARD

UNIX FILE

Continued from page 29

continues: "The lack of portability between System V and 4.?BSD and Version 7 is the worst problem that confronts us." This problem will continue to plague the UNIX world for some time, perhaps for all time. AT&T Technologies is pushing System V as *the* standard version of UNIX, but this claim will not hold up—there are too many people using Version 7 and Berkeley versions of UNIX. More about System V in a later column.

Of this and that

Here are not one but two more directories of UNIX software. One is by **Onager Publishing,** *289 S. San Antonio Road, #204, Los Altos CA 94022.* The cost is $35; they take VISA and Mastercard. The other is from **Whitesmiths, Ltd.,** *97 Lowell Road, Concord, MA, 01742, (617) 369-8499.* This one lists applications software that runs on their IDRIS system, and includes some information on IDRIS itself.

Relational Database Systems is developing versions of its informix database system in German, French, and Japanese *(Kanji)*, and is aggressively marketing Informix overseas through cooperative marketing agreements with agents around the world.

AIM Technology has versions of **tar** which run on VAX/VMS, Data General AOS, and something called MPX-32. Sounds like a good way to move data to/from these systems, since **tar** is *the* standard for moving data via magnetic tapes among real UNIX systems. **Aim Technology,** *3333 Bowers Ave., #199, Santa Clara, CA 95051, (408) 727-3711.* A lower-cost option for the do-it-youselfer would be to get the Software Tools User Group archiver and port it to whichever system(s) you need to move data to/from; the AIM software is ready to run.

Enough for now. If you have questions, please feel free to write or (better yet) send **uucp** mail. I can't always answer immediately, but I will get back to you. And I'm always glad to hear from readers with comments either on the column itself or on their reactions to particular UNIX systems or products.

The UNIX File looks at many aspects of the UNIX operating system. If you have comments or questions about UNIX or this column, feel free to write to me at Box 603, Station F, Toronto, Ontario, Canada M4Y 2L8.

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CIRCLE 126 ON READER SERVICE CARD

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CIRCLE 92 ON READER SERVICE CARD

The CP/M Bus

I/O redirection in CP/M Plus

by Randy Reitz

CP/M Plus has taken a giant step over CP/M 2.x in the area of I/O redirection. Since this is one of the "plusses" available in CP/M Plus, I think it will be useful to look carefully at what I/O redirection capabilities CP/M Plus has.

I/O redirection refers to controlling the source for input data consumed by an application program, as well as the destination of the output data produced by an application. A typical application program may be designed to get its input (either commands or data) from a terminal and display its results on a terminal. This may be acceptable for everyday use of an application, but there are times when the requirement to always use the terminal can become a burden.

For example, input for an application may have arrived in the mail to be keyed in by an operator; but after adding a modem to the system, input may now arrive in machine-readable form. It does not help productivity to have to print this data out so that an operator can key it back in. This example demonstrates the need for an application that could accept input from either a terminal or a file. Similar examples can be found for alternate uses (destinations) for output from an application.

One response to the need for greater flexibility in the sources/destinations of data would be to design each application so that the desired I/O configuration could be specified. It doesn't take much imagination to decide that this is not the way to achieve greater I/O flexibility. Every application would need to include code for its implementation. The proper place to provide I/O redirection is in the *operating system.* With I/O flexibility in the operating system, every application, no matter how simple or sophisticated it may be, can make use of I/O redirection.

CP/M Plus provides two commands that allow the redirection of console I/O from/to disk files. The commands are called GET and PUT, and the syntax is simple:

```
GET {CONSOLE INPUT FROM} FILE
       filespec {[options]}
PUT CONSOLE {OUTPUT TO} FILE
       filespec {[options]}
```

The braces ({ }) above denote optional text or command options; they are not part of the command syntax. The GET command prepares the operating system to access the file named in **filespec** and uses its contents for all input requests of whatever application runs next. Similarly, the PUT command will set up redirected output to the file named in **filespec** for the next application. It is important to note that the GET and PUT commands interact with the *next* command by redirecting I/O from/to a disk file.

Options for GET allow the console input to be ECHOed or not (NO ECHO). If the SYSTEM option is used, the file named in **filespec** is opened, and the system immediately uses the contents of the file for input. The file **filespec** must explicitly redirect the input source to the console by inclusion of the command

```
GET {CONSOLE FROM} CONSOLE
```

as the last line of the file. If the SYSTEM option is not used, the system waits for a command from the terminal, and then uses the contents of **filespec** for input. When the end of the file is reached, the system input automatically reverts to the terminal.

Options for PUT allow the console output to be ECHOed or not as well as to be FILTERed or not (NO FILTER). The FILTER option refers to the treatment of control characters in the redirected output. If FILTER is in effect, control characters will be converted to a two-character sequence (for example, the character Control-C will appear in the output file as ^C). This is a handy option for discovering what mysterious control codes an application is sending. The SYSTEM option is available for PUT and will allow the output redirection to remain in effect beyond the next command. The command:

```
PUT CONSOLE {OUTPUT TO} CONSOLE
```

must be used to end the effect of the SYSTEM option. The PUT command can specify the PRINTER as well as the CONSOLE in the above commands.

The GET and PUT commands handle I/O redirections that involve CP/M files. CP/M Plus provides the DEVICE command to handle I/O redirections that involve character devices such as terminals, printers, modems and whatever else may be attached to the computer system. Good old IOBYTE is not used in CP/M Plus.

The CP/M modular BIOS provides a "device table" that is used to describe all physical devices managed by the BIOS. The DEVICE command is the user interface that allows this table to be examined and modified. The device table contains up to 16 entries (devices). Information found in the device table includes the name of each device;

whether the device is serial or parallel; the baud rate (if serial); whether the device is suitable for input, output or both; and the applicability of the XON/XOFF protocol. The command:

```
DEVICE NAMES
```

will list all of the device table information about the physical devices attached to the system.

The CP/M Plus BIOS contains function calls for three logical devices: the console, auxiliary device, and the printer. The console and auxiliary interfaces have input, output and status (for both input and output) functions. The auxiliary logical device replaces the logical reader punch devices that the CP/M 2.x BIOS supported. The inclusion of full status information for the auxiliary device now allows device-independent modem programs to be developed for CP/M Plus.

The CP/M Plus BDOS maintains five redirection vectors as part of the System Control Block. These vectors apply to console input (CONIN:), console output (CONOUT:), auxiliary input (AUXIN:), auxiliary output (AUXOUT:), and printer output (LST:). The DEVICE command allows these vectors to be examined and modified. The command syntax is:

```
DEVICE logical-dev = physical
       device {options}
```

and is reminiscent of the CP/M 2.x STAT command.

Each character redirection vector is 16 bits long, and each bit corresponds to a physical device described in the device table above. When an output BIOS function is called, the contents of the appropriate redirection vector are scanned and the output character is given to each physical device that has a bit set. When an input BIOS function is called, the contents of the appropriate redirection vector are scanned and a character from the *first* physical devices specified in the input vector is continually scanned (polled) until one becomes ready.

Finally, the DEVICE command can be used to report on the current setting of device characteristics and redirection vectors. One special physical device called NULL is provided that allows any of the logical devices to be disconnected from the system by resetting all the bits of the redirection vector. DEVICE will not allow NULL to be assigned as the console, thereby preventing a system lockout via:

```
DEVICE CONIN:=NULL
```

In summary, CP/M Plus provides full file I/O redirection for the console and printer (output only) with the GET and PUT commands. The DEVICE command provides control of all characters I/O devices, but no file redirection.

Missed opportunities

After this review of CP/M Plus I/O redirection capabilities, I am prompted to speculate on an alternate design for this important feature. Compare the following two commands:

```
GET CONSOLE FILE XYZ ! DOIT
                     (CP/MPlus)
```

versus

```
DOIT < XYZ     (Alternate design)
```

The action of the GET command was explained above; note that the "!" character is used in CP/M Plus to separate multiple commands on a line. The CP/M Plus command line first runs GET, which prepares the system to pro-

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CP/M BUS

Continued from page 33

vide the next command with input from file XYZ, and then runs the next command, which is DOIT. Two commands are required to accomplish this simple task in CP/M Plus. The alternate command line above contains the single command DOIT and embodies the input redirection concept in one character, namely <. This is terse and maybe confusing for the new user but I feel that after a minimum of training, the terse version of input redirection will be preferred. Who wants to do the extra typing required in the CP/M Plus command line? Similarly, compare these two commands:

```
PUT CONSOLE FILE XYZ ! DOIT
                        (CP/M Plus)
```

and

```
DOIT > XYZ      (Alternate design)
```

These two commands have the same meaning, since output redirection can be specified by the single character > Finally, look at these two commands:

```
PUT CONSOLE FILE TEMP ! DOIT1 !
    GET CONSOLE FILE TEMP ! DOIT2
```

and

```
DOIT1 | DOIT2
```

Reading the CP/M Plus style command line (it barely fits on a line), we see that the output of command DOIT1 is desired as the input of command DOIT2. The second command expresses this desired result succinctly, using the | character that is called a "pipe" in some other operating system. The CP/M Plus style command line is so verbose that it obscures this very useful concept. The terse | syntax serves to highlight the idea that the output of the first command is desired as the input of the second command. Once the pipe feature is made easy to use, the development of a class of commands called filters is the next logical step. Filters are designed to perform one simple function on their input, and don't make any assumptions about either their input or output. A collection of filters forms a basis for software tools that can be used to build more useful functions easily and quickly. The benefits of filters are all the more powerful because of the easy way an operation system allows them to be connected.

My point is that CP/M Plus provides the capability for full input/output redirection, but the syntax chosen is clumsy. There is an argument that the separate commands for file redirection, GET and PUT, provide additional flexibility over < and >, since the GET and PUT commands accept options and PUT can capture the printer output. Providing the <, >, and | syntax in addition to the GET and PUT commands would have been the best solution.

The proper place for implementing the <, >, and | syntax is in the Console Command Processor (CCP). In CP/M Plus, the CCP runs in the TPA as an ordinary application program. In theory, then, it should be possible to implement an "enhanced" CCP and install it into a CP/M Plus system. I disassembled the CCP to see if enhancing it with these redirection commands would be simple. I was discouraged after finding that the first 200 bytes only manipulated the System Control Block in areas that the CP/M Plus documentation referred to as "reserved for system use." There are a lot of secrets in the CCP that the documentation doesn't reveal. Enhancing the CCP will have to wait for another time.

Another missed opportunity is in the way character devices are handled.

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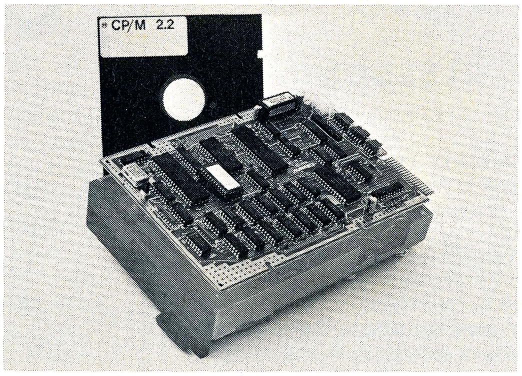

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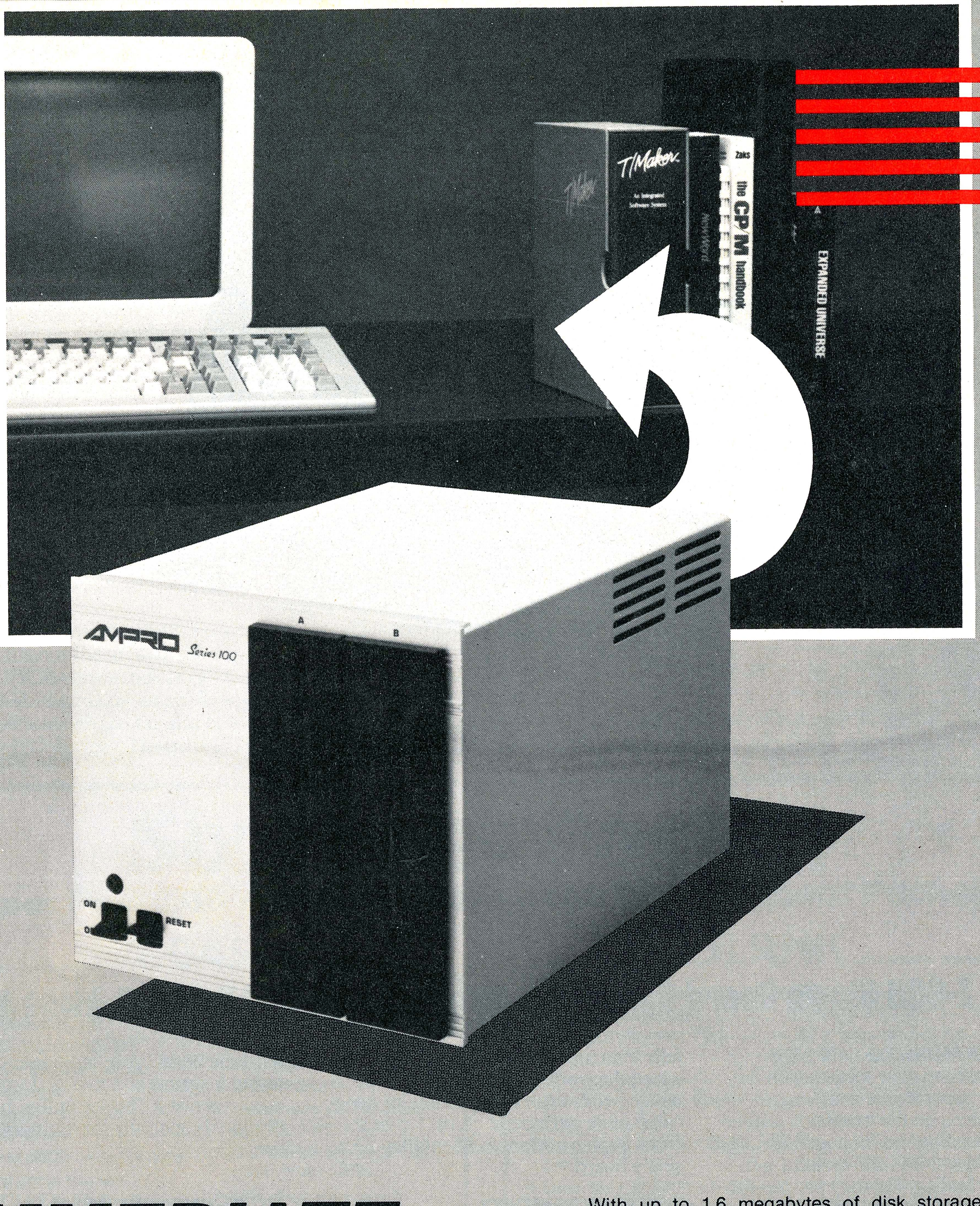

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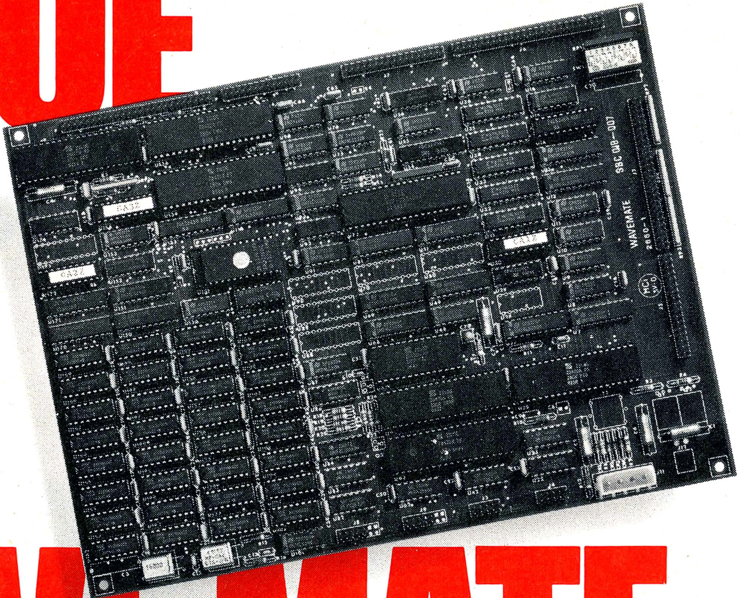

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CIRCLE 177 ON READER SERVICE CARD

CP/M BUS

Continued from page 35

CP/M Plus maintains an artificial distinction between character and block I/O devices. This distinction prevents useful arrangements from being established. For example, let's suppose that modem support has been implemented in the BIOS and a communication program has been developed that uses the auxiliary device BDOS calls. For testing the modem program, the following hypothetical command would be useful:

```
DEVICE AUXIN:=filespec
```

The idea is that typical responses of a remote system could be saved in a file and played back for testing a feature of the modem program (an automatic login feature, for example). Another testing command would be:

```
DEVICE AUXOUT:=filespec
```

This command would "stuff" the contents of a file out the modem. Neither of these DEVICE commands is valid, since CP/M Plus makes an artificial distinction between character and block (disk file) I/O devices. Hence the GET and PUT commands will handle only block (disk file) I/O redirection, and the DEVICE command will handle only character I/O redirection. This means that disk files can never* be redirected to either the AUXiliary or printer devices. Wouldn't it be more consistent to type

```
DEVICE LST:=filespec
```

rather than

```
PIP LST:=filespec
```

to get a listing of the file? As before, this missed opportunity can be found by providing a disk as one of the devices that the BIOS device table supports. I suspect that this could be done, but I haven't tried.

An alternative design used by some other system is to treat all I/O as file I/O. The character devices attached to the system are treated as files by the same system.

This simple idea to "standardize" all I/O leads to programs that work equally well whether attached to a terminal or modem device. The I/O redirection concept contained in the < and > characters will work with character devices as well as with disk files, since all I/O is treated as file I/O.

Summary

CP/M Plus has greatly improved the I/O redirection capabilities over those available in CP/M 2.x. Full file I/O redirection is available for the console function (using a BDOS perspective), and limited redirection is available for the auxiliary and printer functions. I feel that with only a little additional work, the CP/M Plus developers could have included the I/O redirection syntax that is used by other systems and could have removed the artifical distinction between character and block I/O devices. Since CP/M Plus is likely to be the end of the road for CP/M-80 type systems, these enhancements may arise out of the public domain or third-party developers.

**I realize that saying "never" leaves me open to some hacker solution for getting the auxiliary device redirected to a file. Outside of implementing a special physical device in the BIOS for disk I/O, I don't see any way to do it using the GET, PUT and DEVICE commands.*

Randy Reitz, 26 Maple St., Chatham Twp., NJ 07928

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CIRCLE 53 ON READER SERVICE CARD

The MS-DOS Window

The MS-DOS shell command, IBM portable PC, and MS-DOS on DEC equipment

by Hank Kee

During the 'fifties, America dominated the Hi-Fi industry with names like McIntosh, Marantz, HH Scott, Fisher, Sherwood, and others. But this highly innovative industry has long given way to the Japanese. The same may also be said of other electronics industries in America.

Within the microcomputer industry we have seen companies like Vector Graphics, Osborne, Victor Technologies, Timex, Texas Instruments, and Atari fall upon hard times in the personal computer market. There will be more casualties by the end of 1984. We cannot blame this on aggressive Japanese market penetration nor on government-supported subsidies. The irony is that most of the shakeout in this industry occured after a "good" old American corporation named IBM entered the personal computer business. This should put a damper on the notion that an impending Japanese invasion in the PC market is what will hurt American businesses.

In my April column, I had referred to Colby Computer selling a ready-made chassis with power supply and video that you can populate with IBM PC parts, including the motherboard, from Big Blue. Since then, I have received numerous queries about how to get in touch with Colby. Their address is: **Colby Computer**, *Division of Colby Research Industries, Inc., 849 Independence Ave., Mountain View, CA 94043; (415) 968-1410.*

The Shell command

Have you ever gone through the frustration of intermixing programs written in Basic with assembled object code without manual intervention? There is a very easy way of accomplishing this within IBM's BASIC, which is the Basic, customized by Microsoft for IBM, that PC-DOS systems are supplied with. Incorporated into IBM's BASICA (an advanced version of IBM's BASIC) A2.10 and Basic D2.10 is the ability to execute commands at the operating system level.

Within these versions of BASIC exists the use of the SHELL statement, which is similar to a CALL statement or USR function. Don't look for this in your manuals—it is not documented. This statement may be either a direct statement or imbedded within a BASIC program. The SHELL command permits the user to execute an instruction at the command level and still maintain control in BASIC. Here are some examples of the SHELL application:

```
example 1:   SHELL "DIR"
example 2:   5 CLS
             10 SHELL "WS"
             20 CHAIN "NEXTPROG"
example 3:   SHELL
```

In the first example, the use of the SHELL command will display the directory of the current drive. The SHELL command may be written either as an internal or an external statement. In Basic, the CALL statement and USR function require prior loading of code. The SHELL command can also reference programs on the diskette.

It is even possible, as in example 2, to run WordStar between Basic commands. At the command level, you may invoke a system which will remain at that level until program completion. At program end, control returns to BASICA. The only limitation is that neither BASIC A2.10 nor BASICA A2.10 may use a SHELL statement to re-enter itself.

It is possible, however, to invoke BASIC A1.10 as extracted from PC-DOS 1.10. There is a difference in memory requirements among the different versions of Basic in PC-DOS 1.10 and PC-DOS 2.1. By transferring BASIC A1.10 onto the PC-DOS 2.1 system diskette, the user can specify a variable file and record length requirement with each Basic program that may be chained together.

If quotation marks are inadvertently omitted, as in example 3, you would be locked into the SHELL and unable to exit. I guess you could call that a "deadly embrace." Of course, you can always reboot.

In practical terms, SHELL can be used to invoke a series of program executions intermixing BASIC with object programs at the command level without requiring manual intervention.

With the release of the IBM PC*jr*, a cartridge version of Basic, the J1.00, is used under PC-DOS 2.1. A SHELL command can be initiated, but at command termination it will automatically exit to the operating system. The SHELL command therefore doesn't really work on the PC*jr*.

The IBM portable personal

The recently released IBM portable PC may put a further squeeze on the current crop of IBM clones. This system lists at $2,795 and offers:

- 256K available memory, expandable to 640K
- expansion connectors (four short for I/O and one long for system expansion board)

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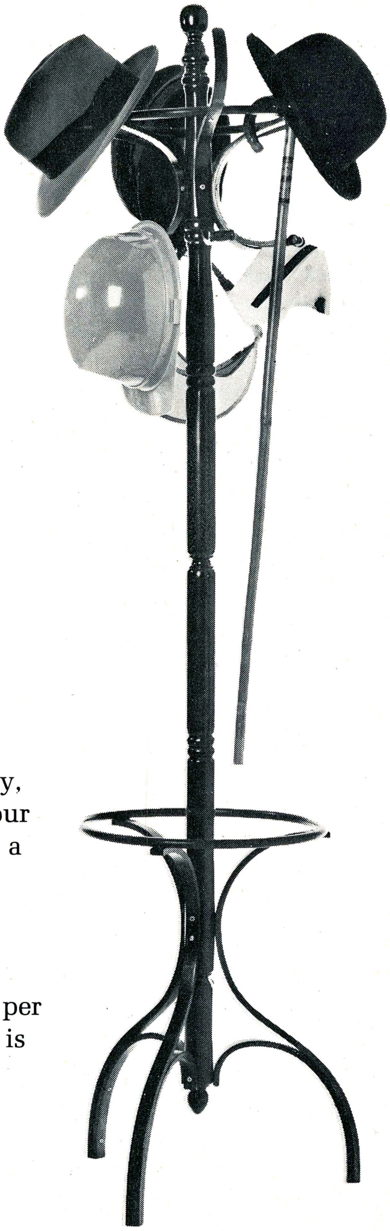

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MS-DOS WINDOW

Continued from page 38

- a color graphics adapter interfaced to a 9″ amber composite monitor
- the ability to internally add a second slimline diskette drive at $425
- use of existing PC software

The amber monochromatic display on the portable PC is quite sharp. I was very impressed with the display even though it flickered on scrolling. For some reason, this was not as objectionable as was the color display adapter connected to an RGB color monitor: in reverse video, subtle shading in monochrome was difficult to view.

Just think of the portable PC as a modified XT unit housed in a transportable case (30 lbs) without the fixed disk drive. At $3,220 for a two-drive 256K system, the portable PC will make it tough for the IBM clones to remain competitive.

The Rainbow connection

After a somewhat uneventful entry into the personal computer world with the Robin VT180 (an add-on to the VT100), Digital Equipment entered the PC market with three stand-alone PCs in June 1982: the DecMate 2, the DEC Pro 350, and the Rainbow 100. The first, DecMate 2, interfaces with DEC's office systems automation offering, the All-In-One, operating under VMS on the VAX minicomputers.

The second, the DEC Pro 350, was designed to take advantage of the DECUS (Digital Equipment Corporation User Group) library. The advertising concentrated on this product, but the DECUS library, which contains mostly engineering-oriented programs, did not appeal to the public.

The portable PC will make it tough on the IBM clones.

Most mainframe manufacturers applied mainframe selling concepts to the minicomputer market—and failed. The merger of Honeywell and Computer Control Corporation (CCC) in the late 'sixties is an example of this. CCC, at that time one of the largest minicomputer companies in the world, is no longer heard of. DEC, however, was successful in this area because they understood the audience that would buy minicomputers. But when they applied minicomputer sales concepts to the personal computer market, the results were disappointing. Reacting to the lukewarm reception for the Rainbow, DEC drastically altered its marketing policy—and the Rainbow's design. Last summer, they made the Rainbow's architecture open—a move that has changed the Rainbow from being merely a well-made personal computer to a viable competitor for IBM in corporate sales.

One of the stumbling blocks for the Rainbow has been the lack of a FORMAT program; this forced users to buy preformatted diskettes from DEC. Another problem was that the market had shifted toward MS-DOS, whereas DEC offered only CP/M. CP/M-80/86 was available, but without means of converting the massive 8″ library to 5¼″ media. Moreover, there was a limit of 256K on the original Rainbow's memory. Though well-made and well-engineered, the Rainbow needed applications programs to make it useful.

Hopefully, all that has changed. Digital Equipment has made MS-DOS available. It has extended the memory limits on the Rainbow to 896K with the introduction of the Rainbow 100B. The 100B provides almost 50% larger spreadsheet capacity than what is now available on the IBM PC. And DEC has announced the availability of a sandwich board to extend the upper limits of the Rainbow 100A (the original product) to 832K.

DEC has also made available fixed disk storage similar to the IBM XT, with the attendant sin of not providing adequate means for data retention other than floppy diskettes. It has set up an Independent Software Vendor (ISV) Group to work directly with third-party software vendors to convert or develop new software products for the Rainbow market. Thus DEC's marketing effort in the personal computer field is now focused on the Rainbow, and the official operating system for it is MS-DOS.

On the MS-DOS operating system, there is a program called RDCPM that permits the user to convert data files from CP/M to the MS-DOS format. Although RDCPM is available, it is still necessary for many of us to migrate data between MS-DOS and CP/M. Also, the world as we know it today revolves around IBM. Personal computers must

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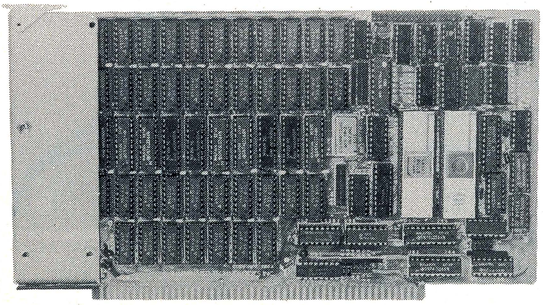

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be able to freely interchange data files with the IBM PC in the corporate environment. However, the Rainbow uses single-sided 96 TPI drives, while the IBM PC uses double-sided 48 TPI drives.

Digital Equipment has released a program called DOSFLX that permits the user to transport data from MS-DOS to CP/M on the Rainbow. This is an add-on to the operating system, but another one still exists: that of read-only capability from the IBM PC to the Rainbow. It is not possible, with the standard offering, to write a diskette on the Rainbow that can be read by the IBM PC.

I recently came across a program called Media Master offered by MDG and Associates that not only allows for MS-DOS and CP/M file interchangeability on the Rainbow, but extends the Rainbow's ability to read and write to formats for other systems, including the IBM PC. I was skeptical as to whether it was possible to write to a floppy with a 96 TPI drive to be read by a 48 TPI drive, it worked. This package has been very well put together. "Media Master" is highly recommended to all Rainbow users. It requires only that a virgin diskette be formatted single-sided on the original system. Through what Media Master calls the ALTER command, the user may modify "precompensation" values when writing.

Media Master offers a fairly comprehensive set of functions: • COPY file(s), • PRINT directory, • DISPLAY directory, • LOG in a new diskette, • ERASE files(s), • VERIFY on write toggle, • ALTER writer precompensation, and • EXIT.

DEC altered its marketing policy—and the Rainbow's design.

It costs $99.95; it's available from **MDG and Associates,** *4573 Heatherglen Ct., Moorpark, CA 93021; (805)-529-5073.* The following are SSDD-compatible formats supported by "Media Master":

DEC Rainbow CP/M, MS-DOS;
  VT-180 (Robin)
Osborne
Morrow Systems
IBM PC CP/M, PC-DOS 1.0, PC-
  DOS 2.0
Heath Z100 CP/M, w/Magnolia;
  Zenith Z90
TI Professional CP/M
KayPro II
Xerox 820-II
NEC PC 8001A
Access Matrix
TRS-80 w/Memomy Merchant
Cromemco CDDS; w/Int'l Term
LOBO Max-80

And that, my friends, is a very impressive list.

We now have the heavyweights vying for the PC market. IBM and Digital Equipment are numbers one and two, respectively, in the computer industry. Apple Computer, hopefully, will be able to maintain its share of the market with the Macintosh and Lisa follow-on products. This will make the invasion of personal computers into the American market from foreign shores all the more difficult.

Hank Kee, 42-24 Colden St., Flushing, NY 11355

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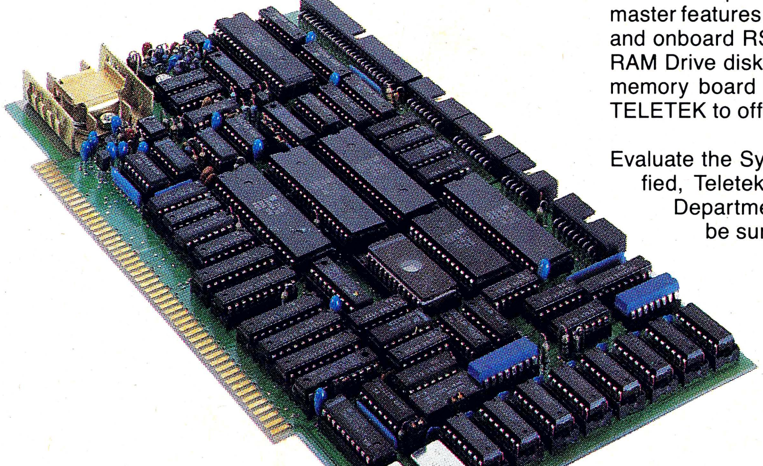

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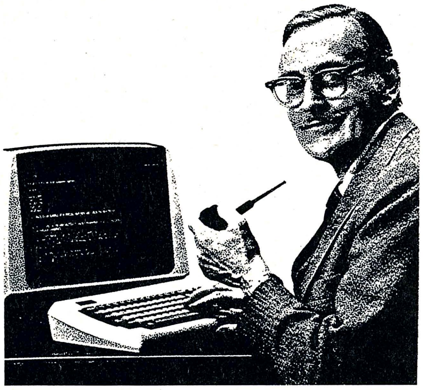

Public domain software for the IBM PC

by Chris Terry

To date, this column has discussed CP/M software available from the CPMUG and SIG/M libraries. However, because the amount of public domain software running under MS-DOS or PC-DOS on the IBM PC has dramatically (and theatrically) increased, it is time to take a look at some of these programs. Initally, many programs were adapted for 8086/8088 machines from corresponding programs available for 8080/8085/Z80 machines running CP/M-80. Today, most of the programs appearing in the public domain are designed from the start to run either on generic MS-DOS 2.0 machines or on the IBM PC and its clones.

Sources

The bulk of the PC/MS-DOS public domain software has been contributed to user groups by members or well-disposed companies and educational institutions. It is available either on RCPM and RPC stations around the country, or in disk form from the growing number of IBM PC user groups. So far, no group has emerged as the unquestioned leader, in the way that CPMUG and SIG/M did in the CP/M-80 field. However, three groups have issued extensive catalogs of public domain software and will probably remain among the primary sources:

1) **The New York Amateur Computer Club (NYACC)**, whose IBM PC Users' Group has assumed the coordination and cataloging of public domain software for the IBM PC (PC/Blue library) from New York and New Jersey sources. (SIG/M, which is a subgroup of the Amateur Computer Group of New Jersey (ACG-NJ), retains responsibility for disseminating CP/M-80 and CP/M-86 public domain software).

2) **Silicon Valley Computer Society (SVCS)** has issued a catalog of 55 disks of PC/MS-DOS software. SVCS appears to be the largest of the west coast groups, and disks issued by other of the many IBM PC clubs in California appear to be duplicates of, or included in, the software cataloged by SVCS and PC/Blue.

3) **SIG/86,** an international MS-DOS users group in the northeast, publishes an extremely interesting newsletter and has issued a number of disks of MS-DOS public domain software. This group states that its interest is in systems and software for generic MS-DOS, not PC-DOS.

Addresses of these groups are given at the end of this article.

Telecommunications

Telecommunications programs for the IBM are starting to proliferate. There are many well-known items, such as an IBM PC version of Ward Christensen's MODEM (PC/Blue Vol. 37, SVCS Vol. 9), PC-TALK (PC/Blue Vol. 7, SVCS Vol. 40 & 41, and PC/Blue Vols. 27-28). The MODEM7I program on SVCS Vol. 9 is specifically a version of MODEM7; the MODEM program on SVCS Vol. 45 is stated to be version 3.0, but it is not clear from the catalog whether this means it is an IBM version of the old MODEM3, or the third revision of MODEM7I. Check with SVCS before you buy Vol. 45, because if it is a version of MODEM3 it may not have either batch file transfer or CRC error detection. Older versions of MODEM used checksum error detection, which can allow a few errors to slip through undetected, whereas the CRC method gives a probability of 99.997% of catching all transmission errors. In addition to these well-tested packages, there is a communications program called PC-Dial, and another with the name "1-RingyDingy," about which I have no information (other than the fact that Lily Tomlin did *not* write the documentation). I would be interested in hearing from anyone who has used either package.

The SIG/86 user group is interested in systems and software for generic MS-DOS, not PC-DOS.

The PC/Blue library also has two bulletin board systems, one in Vol. 45, the other in Vol. 49. The latter is a full remote bulletin board system (RBBS) and is designated CPC version 12.1.

Statistics

Volume 53 of the SVCS library (and PC/Blue Vol. 40) is devoted to statistics programs in Basic (presumably BASICA). In addition to a data entry and editing program, there are 17 programs for obtaining statistical data from a sample (analysis variance, chi-square, correlation coefficient, normal distribution, rank sum tests, etc.); one program for displaying data histographically, and one utility to transfer data samples from one file to another. I am not a statistics expert, but the collection looks as though it should be useful for a variety of statistical purposes. And, as with all public domain software, if you don't find what you need, you can always make additions and modifications.

Utilities

Many of the utilities available under CP/M-80 have been modified for use on an IBM PC equipped with the Xedex Baby Blue board. Three disks of the NYACC (PC/Blue Vols. 1, 16 & 17) contain miscellaneous utilities including SDIR (Super Directory), CRCK (disk and file checksums), DU, and many others. Volumes 18 through 53 of the PC/Blue library contain entirely native PC code and should run on all IBM PCs with no modification. Programs available in this form include PC-FILE (a database package), a keyboard definition program, a cheap assembler, and several cryptography programs.

> **Many CP/M-80 utilities have been modified for an IBM PC that is equipped with the Xedex Baby Blue board.**

Word processing

PC/Blue Vol. 39 contains a screen editor and a primitive formatter, and SVCS Vol. 47 has FRED (FRee EDitor), said to be similar to IBM's Personal Editor. SIG/86 Vol. 3 contains TOP, a text output processor using embedded commands. Since this particular disk contains copyrighted material, redistribution is not permitted, and it is available only to members of SIG/86, who will be required to sign a nondisclosure agreement. SVCS Vol. 52 contains PC-WRITE, a word processor that is copyrighted by Quicksoft; however, you may copy and share your disk. If you want to register the disk for updates, the cost is $75; if you don't do this, you are on your own, but it is reputed to be very useful, even without support.

There is a great deal more public domain software for the IBM PC. What areas are you most interested in?

New York Amateur Computer Club
P.O. Box 106
New York, NY 10008

Silicon Valley Computer Society
P.O. Box 60506
Sunnyvale, CA 94088

SIG/86
Joe Smith, *Dept. of Chemistry*
University of Pennsylvania
34th and Spruce St.
Philadelphia, PA 19104

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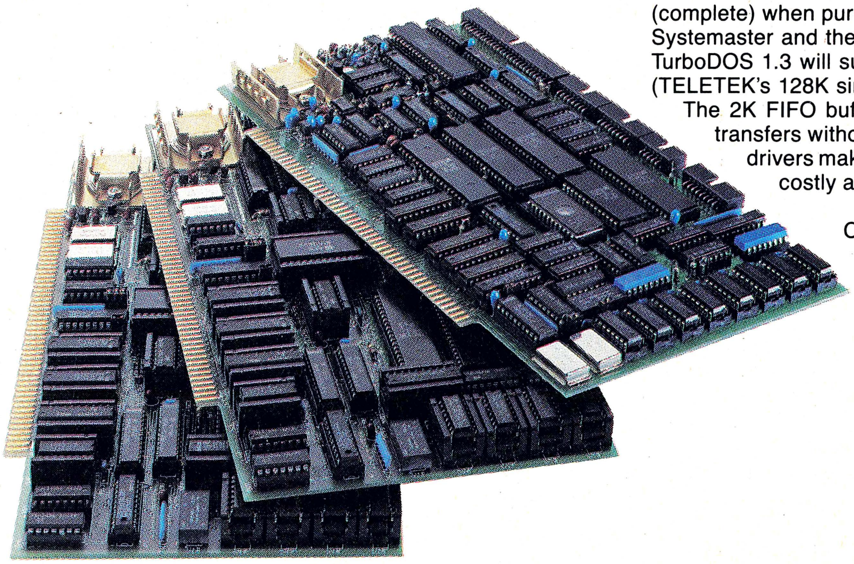

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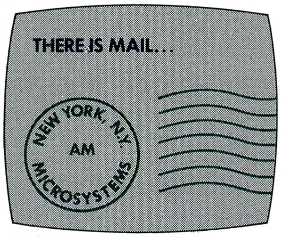
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Letters to the Editor

This month... trig functions in CBasic, the Julian dating system, and DIMS

Dear Sir,

Robert Lurie's article "Improved Trigonometric Functions for CBasic-80" (December 1983) addresses an audience broader than just users of CBasic-80. I'm a newcomer among microcomputer users, but I've quickly learned that Basic dialects flawed by trig that computes single precision only are far more common than I would have guessed. The micro industry must assume trig is irrelevant; inadequacies here are left for the end user to deal with on his own.

I'm a field scientist, partly, in that I indulge myself summers in geophysical field investigations of subarctic mountain glaciers. Like much of field science, this entails data capture and processing needs that beg to be simplified by computer technology. But the worksite provides neither standard electrical power supply nor telephone connection to home-based mainframes.

So I recently bought an Epson HX-20 "notebook" micro, which seems almost ideally designed for technical field work: it has display, printer, tape-drive and rechargeable power supply all built in. It even has a standard keyboard, a simple text editor and the manufacturer's promise of CP/M capability "soon." I've read evertything I can find on similar small systems, both before buying and since, without finding anything that better suits my needs. But its Basic (without double-precision trig functions) renders it essentially useless for professional computation. Data capture will be as much as it will serve for, unless I'm able to implement a software fix such as the one Lurie provides for CBasic-80.

However, three questions still bother me:

1) Since comparable notebook micros, even much smaller systems like the Sharp PC-1500 or HP-75, *do* provide double-precision trig, it's clearly not intrinsically impossible. So why emasculate the math capability of a system otherwise well suited to technical applications?

2) Why is there no mention of this limitation in most of the product reviews available in the industry publications? Completely inplemented trigonometric functions must be of recognized significance, judging from the fact that many manufacturers do provide them; their lack is also by no means a rare product defect.

3) Why does the regional product support company, to whom Epson refers customer queries, fail to provide or even to suggest techniques such as Lurie discusses for addressing the problem? My own letter requesting information from them didn't even elicit the courtesy of a reply; on the phone I got disinterested speculation that there might be something "coming soon." Repeated queries made by my local dealer have produced no response more helpful.

I'm something of an innocent; is this more or less the industry standard for product support? Or has the shoddyness of my own experience been unique?

S. G. Collins
Research Analyst
7 Tenley Drive
West Lebanon, NH 03784

Dear Sir,

I may be one of many to call your attention to a common misunderstanding in the use of the title "JULIAN" when using a dating system that has an arbitrary base date, as was evidenced, at least in the artwork, in the March 1984 issue of *Microsystems.*

I hope I am not being pedantic, but I do not like anachronisms or giving credit to the wrong person for an important improvement in mathematical procedures. The fact of the matter is that the Julian *dating system* has nothing to do with Julius Caesar or the Julian *calendar.* The Julian calendar was first authorized for civil use in Rome in 42 BC. Fourty-five years later Augustus named a month after himself and gave it a final polish. The Julian dating system was named for the father of Joseph Scaliger, whose name just happened to be Julius. And although the system was used by fellow astronomers while working on the development of what is now known as the Gregorian calendar, he did not publish the work until the year 1582, the same year that Pope Gregory XIII authorized the use of the revision.

To be quite exact, the term Julian date should be avoided. The term should be "the day of the Julian Period." The first day of the Julian Period, still in use by astronomers and other mathematicians concerned with geodetic science, is January 0 (noon), 4713 BC. The full Julian cycle takes 7980 years.

Today, March 3 (the astronomical day begins when the sun crosses the meridian for solar time—hence AM-PM) is the 2,445,763rd day of the Julian Solar Period, or the 2,452,460th day of the Julian Siderial Period. Check *American Ephemeris* and *Nautical Almanac.*

When some computer users select as their day 1, January 1, 1978 and others 1980, they are following old Scaliger's logic and choosing a date that is meaningful to them. 4713 BC gave Scaliger a date when the cycles most interesting to him all began on the same day: the Lunar Cycle of 19 years when the moon repeats her phases; the Solar Cycle of 28 years when the days of the week begin their repetition; the Indiction Cycle used in classical Roman calendars before the Julian; and, with slight adjustment, the Metonic-Epact. Scaliger presented his choice with great logic. I only hope the computer scientist can do as well.

R.H. Shedd
8360 Madison Avenue
Fair Oaks, CA 95628

Dear Sir,

Re using DIMS on a limited-capacity system like the Osborne 1 (letter from Benjamin Cohen, Feb. '84 p. 55):

I recently began renting my Osborne 1 to a client to use for data entry, and we are using the following arrangement:

Drive A:	Drive B:
DIMS.BAS	MBASIC.COM
DEDIT.BAS	DATAFILE.DD

The system is started from drive A: by typing "b:mbasic dims." On an 0-1, you can add 400 data records.

Re the DIMS system in general:

DIMS release 1.03 is now available. The differences between this 1.03 and 1.0 are minor. All files are compatible. The best thing is that the default printer listing format is now much more useful. Some errors have been corrected. Performance of the "get" command has been improved. New transient commands "nadin" and "cheshir" have been added. The manual has been updated, and two useful new format control files have been added.

If you get release 1.03, you will have to go through the installation editing again. This consists of rewriting the cursor positioning subroutine in DEDIT.BAS, rewriting the clear screen subroutine in all the other programs, and making similar adaptations for your printer. After you're finished editing don't forget to load and save all the programs with Basic. Running with programs in ASCII form will seem to work for a little while before crashing with a mysterious error.

I will make 8″ CP/M or Osborne disk (2 disks) copies on your formatted disk(s), supplied with return postage. DIMS users may send me a stamped, self-addressed envelope to receive the next bug fix or release notice.

I have installed the entire DIMS 1.03 (except DCFORM, which is obsolete) on an IBM PC. There were more problems translating to BASICA than I'd hoped, but it was pretty straightforward work. Same backspace problem in DEDIT as in the Osborne; same fix. (Backspace on the IBM is chr$(29), by the way!) Biggest bore was editing out all the fancy formatting I'd done with Basic-80's linefeed trick. Maybe they decided—since it's a nonstandard thing and incompatible with WordStar—that they'd dump it.

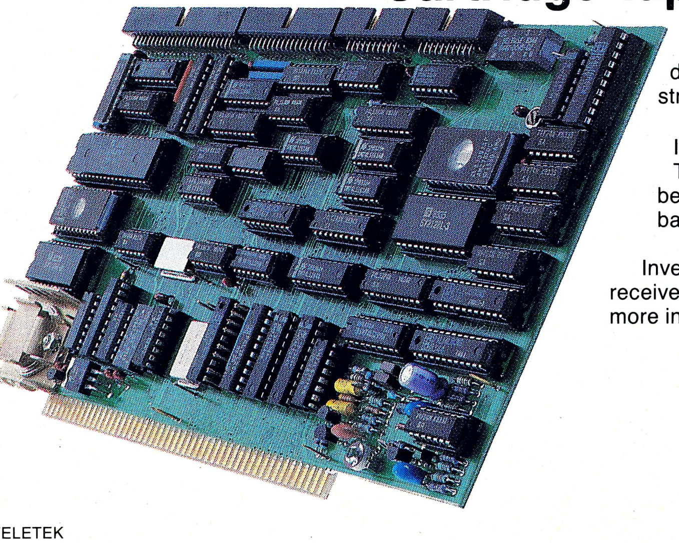
If you are interested in audio engineering, please write for a brochure on my latest product, the FX-series of multichannel preset parametric equalizers.

I'm using my Radio Shack Model 100 for do-lists, appointment calendar (in TEXT), shopping lists, most commonly used phone numbers file, recording notes, and daily journal writing. I wish I could make enough time to write some software for it. In addition, I have a good start on a database management program for the Radio Shack Model 100, which builds from the experience of DIMS. I hope I can get it finished and make it commercial. I also hope someone comes out with a compiler for it!

Dan Dugan
290 Napoleon St.
San Francisco, CA 94124

TELETEK SYSTEMANAGER

One HD/CTC Controls Both Hard Disk and Cartridge Tape Drives.



The TELETEK HD/CTC features a hard disk and cartridge tape controller, both on one S-100 board. This intelligent, two-function controller will support any two ST506 compatible Winchester disk drives and the full range of QIC-02/QIC-24 compatible streaming tape drives.

If a hard disk controller is required, the TELETEK HDC is ideal. The HDC will operate in any S-100 environment and can even be upgraded to a fully functioning HD/CTC should cartridge tape backup be required at some time in the future.

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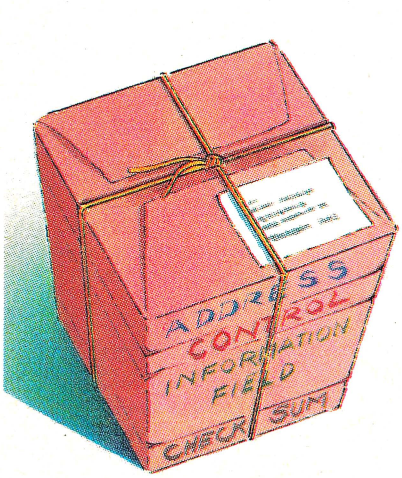
Implementing X.25 Communications Protocol

Part 1: Concepts and specifications



by Eric L. Beser

To the average computer user, *communications protocol* means merely the "handshaking" procedures used in the MODEM and XMODEM file transfer programs found on bulletin boards and RCPM stations. There's nothing fancy about this procedure—the sender transmits a block number, 128 bytes of data and a checksum or CRC, and then waits for the receiver to return a code. If the receiver returns an ACK code, the previous block was correctly received, so the next block is sent. If the receiver returns a NAK code, however, there was a transmission error and the bad block must be retransmitted.

The other common protocol is XON/XOFF handshaking, in which the receiver merely collects data sent to him (with no error checking) into a buffer. When the buffer is nearly full, he sends XOFF, and the host computer stops transmitting until the receiver has emptied his buffer and sends XON to indicate that he is ready for more. For the most part, these two protocols are the only ones that the average computer user will ever see.

However, the professional software developer may have occasion to communicate with a mainframe host computer in a different part of the country, either over a leased line or via one of the commercial time-sharing networks. In such cases the micro user, even though he is logged into the host as a terminal, may have to be able to send and receive data in packets, using packet protocol. This protocol is bit-oriented, rather than byte-oriented, and requires different hardware as well as different software. It is capable of greater speed and accuracy than the simpler protocols—transfer rates of megabits per second are possible—and is both flexible and efficient. It forms the basis of the NABTS (North American Broadcast Transmission Specification) used for satellite communications. But for today's micro user, there is another, equally important aspect: the fact that Layer 6, the presentation layer (Figure 1), is the same as the Presentation Level Protocol (PLP) that is currently being used as a Graphics standard in an attempt to achieve portability of graphics programs. More discussions of the graphics aspect of the protocol will appear in future issues of *Microsystems*.

The present series of articles on the communications aspect of the protocol will describe a version implemented under CCITT Specification X.25. (CCITT is the Comité de Communications Internationales de Télégraphes et Téléphones—the regulatory body for all international communications.) Part I of this series provides the background information needed to understand and implement this protocol. Part II, which concludes the series, will describe the hardware needed to implement packet communications and the software to drive it.

I have written the software both in Pascal-MT-86 and 8086 assembly language and implemented a breadboarded 8086 processor using Intel's version of the Z80 SIO-9, the 8274 multiprotocol serial converter for the packet hardware. I have also used and written drivers for the Intel 8273 HDLC controller, but the 8274 is cheaper and more readily available. The Z80 SIO-9 converter may be substituted without modification to the software drivers.

Layered architecture

Computer networks are designed to be highly structured to reduce their complexity. Primarily they are designed around layers, one built on another. The purpose is to offer services to the other layers, shielding details of how the services are rendered. Each layer provides an interface to the other, and these interfaces define what services the layer provides. This concept of clean interfacing is important and will be seen again and again in our examples. It means that, by using layered architecture, you can strip out a layer and replace it with another one without affecting the neighboring layers. If you wish to implement a communications protocol other than the one specificed in X.25, you may do so by changing the proper layer. This concept of layered architecture provides the core to my implementation of X.25 and will conform to the model presented below.

A model for communications architecture was proposed by the International Standards Organization (ISO) as a first step toward standarization of the various communications protocols. The reference model of Open Systems Interconnection (OSI) is the first concept necessary to learn on the road to implementing packet software. Several major principles were applied to arrive at the seven layers illustrated in Figure 1. These principles were simply that:

- A layer should be created where a different level of functioning is needed.
- Each layer should perform a single, well-defined function.
- The function of each layer should be chosen so that various protocols could be standardized.
- Information flow across the layered boundaries should be minimized.

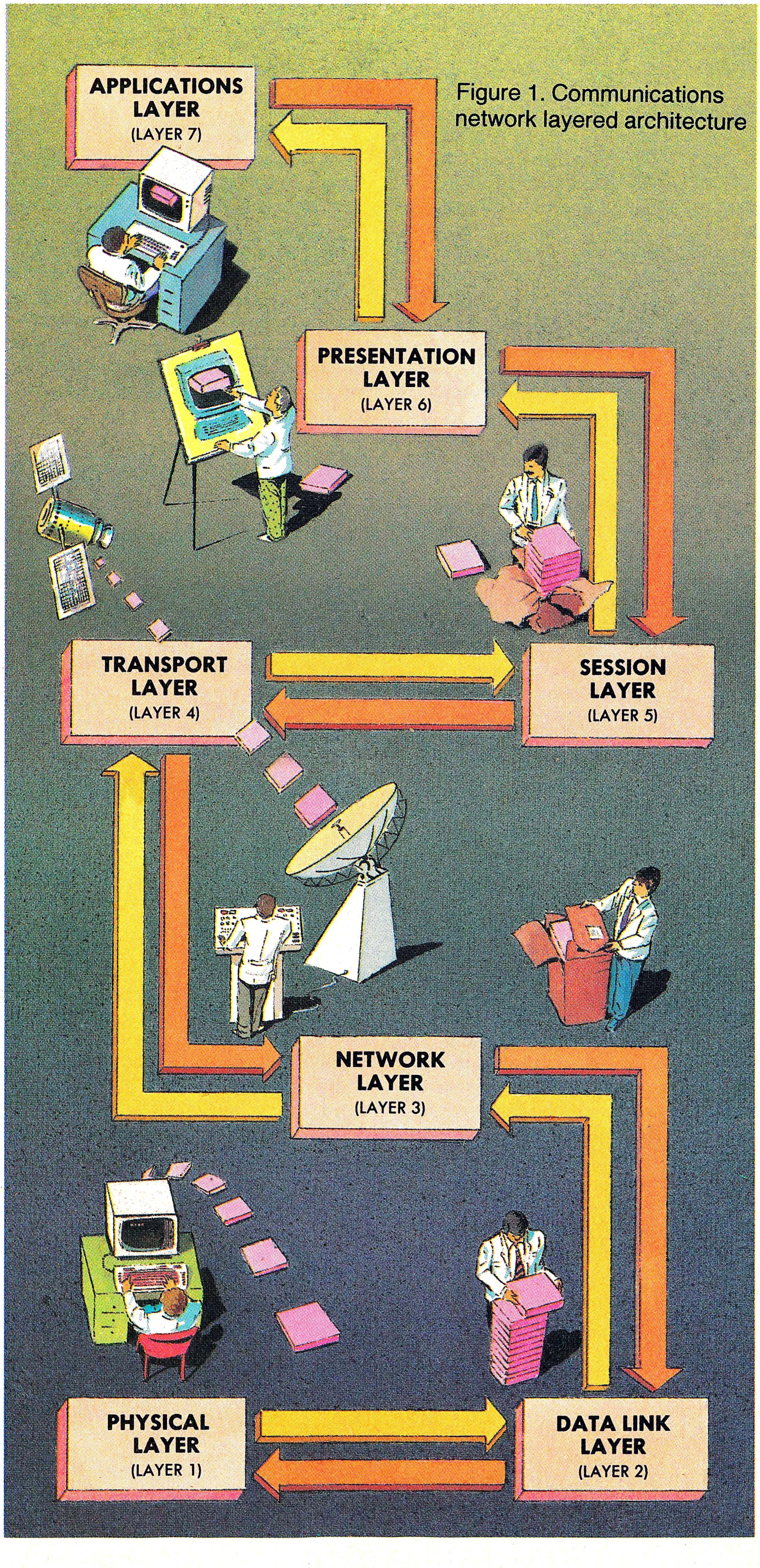


Figure 1. Communications network layered architecture

X.25 PROTOCOL

Continued from page 47

- The number of layers should be chosen so that different functions have different layers.

Physical layer

The function of the physical layer is to send bits of data across a communications channel. Of concern to us in this layer are the electrical connections, the maintenance of communications between hardware, and the physical functioning of the communications device. If the Data Carrier Detect Line goes high, or if the clock is lost, this is a physical layer functioning. The initialization of the hardware, providing the hardware with an address of a data buffer, is a physical layer function.

In our implementation of X.25, specialized hardware is needed. Most Z80-based systems have a Z80-SIO chip, which is ideal for packet applications. Another hardware item is the Intel 8273 HDLC controller. Still another is the 8274 MPSC, which I have used in my implementation. By changing only the physical layer, either one chip or another can be accommodated. As you will see in our later discussion on hardware, physical layer implementation is a matter of properly initializing the hardware and knowing how the hardware functions. I am currently experimenting with Western Digital's 2511 X.25 LSI chip, which has implemented much of the software drivers in microcode. More on that in Part II.

Data link layer

The task of the data link layer is to take raw data and break it into packets, transmit these packets sequentially, and process the acknowledgement packets sent back by the other communicator. Because the physical layer transmits and receives bit streams, it is up to the data link layer to make sense of what was received. Moreover, it must resolve missent data, or data received in an error-prone line. Also there must be buffer management in this layer to keep the transmissions orderly. Buffer management is implemented in this layer as protocol or supervisory frames, which tell the other side what to send and when.

In our discussion and implementation of the X.25 protocol, I will implement it only up to the data link layer (or level 2). However, X.25 extends to the network layer as well (Level 3).

Network layer

The network layer is the heart of he communications network. It is here that packets are taken and routed to the next receiver. In fact, this layer has been known as the post office of the communications network. Packets are addressed and mailed to other units on the network, and may be either routed or broadcast so that all may see and hear. A key design issue is how these packets get routed.

Transport layer

The main function of the transport layer is to accept data from the session layer, split it if need be, and see that it gets to the other side. It may create network connections to improve throughput, and it really provides end-to-end connections. In the microsystem, where there are limited resources, the transport layer is concerned with memory management and management of the various queues and buffers needed by the lower levels.

> **Packet protocol is bit oriented and requires different hardware.**

Session layer

The session layer is the user's interface to the network. This layer provides the file management processes to transfer files from one system to another. On large communications networks, the session layer is the bookkeeper of the operation. It authenticates the connection so that the bill is sent to the right party, and is used primarily in distributed databases that cannot abort complicated transactions. This layer is the beginning of applications functions. In some applications, the session and transport layers are merged to form one layer, or the session layer may be absent.

Presentation layer

The presentation layer presents information to the user or the network in an orderly fashion. In some applications, mostly in large systems, this layer takes ASCII data and converts it into compressed text or encodes it into code words. At the other end, the presentation layer decodes these words back into text so that the user sees only text. Video graphics information is encoded at this level, which allows color pictures, words, and ideas to be presented. Thus vivid graphics displays are transported to the user in the form of video text. The North American Presentation-Level-Protocol Syntax (NAPLPS), adopted by AT&T, and Prestell are two such presentation-level standards.

Applications layer

The content of the applications layer is up to the network user, since it is in this layer that he operates. When you transfer money from your bank using another bank's machine, you are operating in the applications layer. When a travel agent books a reservation, he may tie into that airline's network. In current use, the applications layer will provide a basic operating system, a method of servicing interrupts, and a system-error correction method.

Bits and frames

As protocols developed, the various standards organizations refined and changed their functions. Early in 1970, IBM developed SDLC (Synchronous Data Link Control) and submitted it to ANSI for validation. ANSI modified it to become ADCCP (Advanced Data Communications Control Procedure), and ISO modified it to become HDLC (High-level Data Link Control). CCITT, as part of the X.25 standard, adopted HDLC as part of its LAPB (Link Access Procedure-Balanced). It is this version of X.25 that is currently used.

All of these protocols are bit oriented in that each allows data frames to be of various sizes. The frame size need not be an integral multiple of character sizes, and a frame is separated by a flag

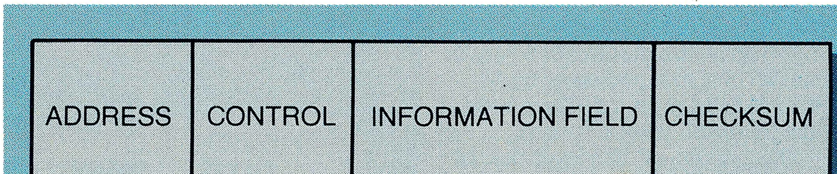


Figure 2. Frame format used in bit-oriented protocols.

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ake this machine table

Table 1. States and events

State	Event	Next state
0	A	1
1	B	2
2	C	2
2	D	0

driven, defining the various states that our machine can be in at any instant of time, plus all the events that can occur while in this state, what actions need to occur because of the events, and what new state will be entered into as a result of the event occurring. The protocol machine is completely determined by the state of its variables. As we will soon see, implementing the X.25 standard becomes simply a matter of deciding what state the system is in and what actions must be taken.

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One of the hardest things to do in implementing the various forms of communication protocol is to understand the specification statements. Every time I read X.25, I found something else I did wrong or did not interpret correctly. The purpose of a specification is to make something specific. This document is full of ambiguities and choices. Let's look first at the general statements and some system parameters, then at specifics. You will very quickly see the value of dividing the protocol responses into finite states.

There are five main phases within X.25: Disconnected, Link Setup, Information Transfer, Exception, and Link Disconnect. There are two modes, asynchronous and balanced. We will concern overselves with the balanced mode, since this mode has superceded the asynchronous mode. Each of the phases can be broken into several states. In our definition of the protocol machine, we will use 10 such finite states. Figure 3 shows the complete state machine for the X.25 protocol, based upon the events that occur within the 10 finite states.

There are system parameters that have to be set. These parameters specify a retry-retransmission count, a timer period, a maximum frame size, and maximum outstanding frames.

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This count is incremented whenever the timer expires, and is set to zero when the data link acknowledges frames, or receives either an unnumbered acknowledgement frame or a Receiver-Not-Ready (RNR) supervisory frame. When this count reaches a

X.25 PROTOCOL

Continued from page 47

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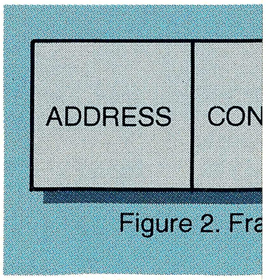

Figure 2. Fra

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byte. But what is used to separate frames from flags? This separation of frame from flag is the reason that special hardware is needed to use bit-oriented protocols. A technique called bit stuffing is performed by the hardware: thus whenever the hardware encounters five consecutive 1's in the data, it automatically stuffs a 0 bit in the outgoing bit stream. Whenever a receiver sees five consecutive 1's, it removes the 0 bit from the data automatically. This stuffing is completely transparent to the software in use.

All the bit-oriented protocols use frame structures as shown in Figure 2. The address field is 8 bits (or multiples of 8 bits as used in ham radio packet networks) and is used to identify the terminals. The control field deliniates information frames from supervisory frames. The data field may contain arbitrary information. The checksum field uses the cyclic redundancy polynomial. Frames are delineated by the flag byte "7EH."

There are three types of frames used in X.25 protocol. These are supervisory frames, which tell when the data link layer can receive data, is busy, or has rejected data; information frames, which contain the data that is to be transferred; and unnumbered frames, which initiate a link, disconnect a link, or reset the data link. Supervisory frames and information frames contain sequence numbers used to acknowledge information frames that have been sent. Unnumbered frames (as you probably have already guessed from the name) have no sequence numbers.

The reason for these numbers is simply that, to increase the efficiency of data transfer, data flows both ways, and the data frames have acknowledgement numbers sent back. This technique is called piggybacking, and the method used in acknowledging frames is called the sliding window protocol.

Two series of sequence numbers are maintained by each side. These sequence numbers are Next_Frame_To_Send and Frame_Expected. Next_Frame_To_Send keeps track of the number of frames sent out, and Frame_Expected keeps track of the frames that have been received. The control field of the information frames contains a 3-bit variable called Frame_Sequence, and another 3-bit variable called Frame_Acknowledge field. As you might guess, Frame_Sequence is a copy of Next_Frame_To_Send, and Frame_Acknowledge is a copy of Frame_Expected. Because these variables are 3 bits long, up to eight frames (0 to 7) may go out before any aknowledgement comes in. A variable called Ack_Expected keeps track of the Frame_Acknowledge numbers as they come in, and is used to decrement the count of outstanding messages. In satellite packet networks, these variables are longer because of the delay in turnaround time. However, keeping the count in modulus 8 allows for a convenient indexing of buffers and a requeuing of data frames if one has been lost. As a frame is transmitted, the Next_Frame_To_Send variable is incremented by each frame sent. As the window gets larger (due to frames being transmitted without being acknowledged), the distance between Ack_Expected and Next_Frame_To_Send gets larger. However, when frame acknowledgements come in (in the form of other information frames or supervisory frames) Ack_Expected gets larger and the window narrows. A timer keeps track of the time spent between frame transmission and probable receipt of acknowledgement. If the time times out without receipt of an acknowledgement, the frame is requeued and sent again.

You can strip out and replace one layer without affecting others.

Finite-state events

The third important concept to understand in the software implementation of bit protocols is a concept borrowed from compiler design: that of the finite-state automata. Stated simply, finite-state automata are directed graph structures whose nodes are called states and whose labeled edges are called transitions. One state (called State 0) is a start state, and there may exist one or more final states. A given state moves to the next state because of an event, as shown in Table 1.

While in state 0 (start state), event A occurs, causing a transition to state 1. While in state 1, event B occurs, causing a transition to state 2. Event C occurs while in state 2, but this event does not cause a transition. Finally, event D occurs, causing a transition to state 0.

Using this technique, we can build a protocol machine that is always in a specific state at every instant of time. We can even make this machine table driven, defining the various states that our machine can be in at any instant of time, plus all the events that can occur while in this state, what actions need to occur because of the events, and what new state will be entered into as a result of the event occurring. The protocol machine is completely determined by the state of its variables. As we will soon see, implementing the X.25 standard becomes simply a matter of deciding what state the system is in and what actions must be taken.

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Continued from page 49

predefined maximum, resetting procedures occur. The specification calls this variable "N2," for reasons known only to the writers.

Timer period

The timer period is a parameter that must take into account the maximum length of time it takes to send a frame and receive a response. In short-line communication hookups (one computer connected to another in the same room or down the hall), this period is in seconds. For satellite transmission or ham radio hookups, this time must be measured in minutes. The time must be the maximum time it takes to send an unnumbered command and get an unnumbered acknowledgement back.

Maximum number of bits in a frame

The maximum bits per frame takes into account the kinds of information to be transferred in the data link and how much memory is required to buffer these frames. Keep back up to the maximum number of frames you may have outstanding, in case you have to retransmit all of them. The largest frame size is 2K long, but the ideal size varies because of the communication line. If the line is noisy, frame size should be smaller. If the line is clean, the frame size could be at a maximum.

Maximum outstanding frames

The maximum number of sequentially numbered frames should never exceed seven. This number fits into the 3-bit control field and is calculated modulus 8.

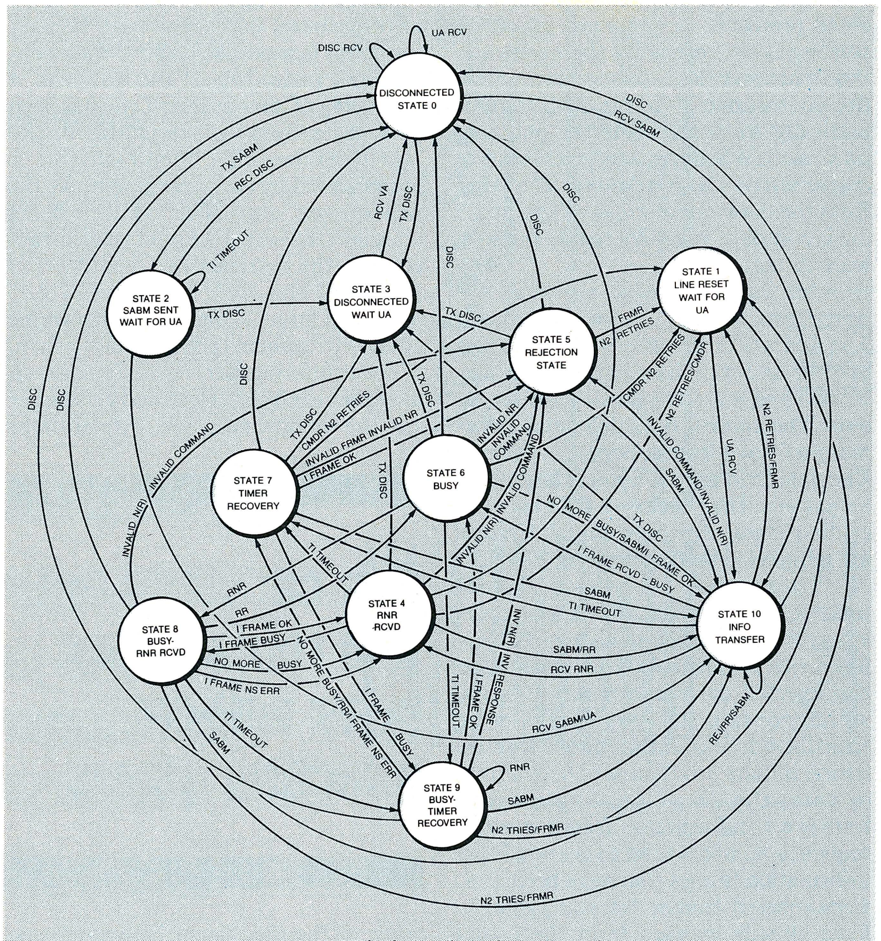
Datalink specific variables

I have already described several specific variables. In light of X.25, I need to be more specific about the nature of these variables.

Next_Frame_To_Send. In the X.25 specification, this variable is known as the sendstate variable, whose value ranges from 0 to modulus -1. This value cannot be more than Frame_Acknowledged + 7.

Send_Sequence_Number. Prior to transmission of an information frame, this variable is set equal to Next_Frame_To_Send. In the X.25 specification, this variable is called N(S).

Frame_Expected. This variable denotes the next in-sequence frame to be expected. This number is incremented whenever a frame is received with a sequence number equal to this value. In the X.25 specification, this variable is called receivestate.



DISC RCV
UA RCV
DISCONNECTED STATE 0
DISC
RCV SABM
TX SABM
REC DISC
T1 TIMEOUT
RCV VA
TX DISC
DISC
DISC
DISC
STATE 2 SABM SENT WAIT FOR UA
TX DISC
STATE 3 DISCONNECTED WAIT UA
STATE 1 LINE RESET WAIT FOR UA
TX DISC
STATE 5 REJECTION STATE
FRMR
N2 RETRIES
DISC
DISC
DISC
CMDR N2 RETRIES
N2 RETRIES/CMDR
TX DISC
CMDR N2 RETRIES
INVALID FRMR INVALID NR
I FRAME OK
TX DISC
INVALID COMMAND
INVALID NR
INVALID COMMAND
INVALID COMMAND
STATE 7 TIMER RECOVERY
STATE 6 BUSY
TX DISC
INVALID COMMAND/INVALID N(R)
SABM
UA RCV
N2 RETRIES/FRMR
INVALID N(R)
INVALID N(R)
NO MORE
BUSY/SABM/I FRAME OK
TX DISC
I FRAME RCVD – BUSY
T1 TIMEOUT
RNR
RR
I FRAME OK
I FRAME BUSY
NO MORE
BUSY
I FRAME NS ERR
STATE 8 BUSY-RNR RCVD
STATE 4 RNR RCVD
SABM
T1 TIMEOUT
STATE 10 INFO TRANSFER
SABM/RR
RCV RNR
NO MORE BUSY/RR/I FRAME NS ERR
I FRAME
BUSY
INV N(R)
INV RESPONSE
T1 TIMEOUT
I FRAME OK
RCV SABM/UA
REJ/RR/SABM
T1 TIMEOUT
SABM
STATE 9 BUSY-TIMER RECOVERY
RNR
SABM
N2 TRIES/FRMR
N2 TRIES/FRMR

Figure 3. X.25 balanced mode—state diagram.

Frame_Acknowledged. This value is set equal to Frame_Expected prior to transmission of a frame. The purpose of this variable is to let the other side know that the frame was received OK.

P/F bit. The Poll-Final bit serves a function in command frames (P-bit) or response frames (F-bit), and is used to elicit the status of the data link, to verify that frames have been received correctly, or to resolve frame collisions. This P/F bit is used in all types of frames.

Save_Sendstate. This variable is used to save the contents of the Next_Frame_To_Send during timeout periods.

Last_Sequence. This optional variable is used to save the last sequence number of the frame received.

Ack_Expected. This value saves the last received Frame_Acknowledge value and is used to release frames from the history buffer. This variable maintains the lower edge of the sliding window that I wrote about earlier. It is important to keep this value, because any frame with a Frame_Acknowledge value that falls outside this window causes the protocol machine to enter into a rejection state.

Commands and responses

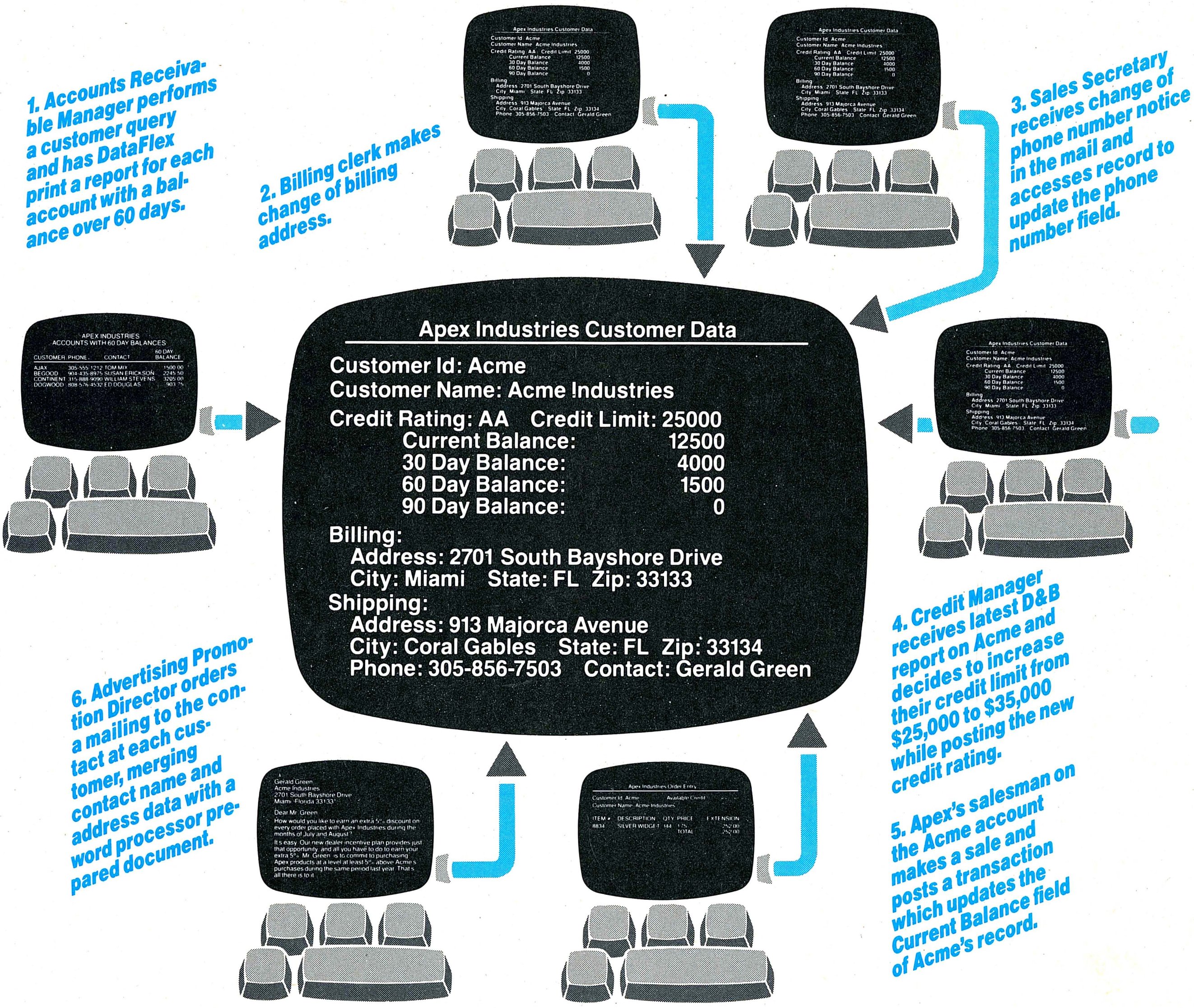
The X.25 specification lists a number of commands and responses to these commands. Table 2 lists these commands and responses and gives the bit layout of the control field. The various frames can be divided into these three types: Information, Supervisory, and Unnumbered.

Information. I-frames are sequentially numbered and used to transmit data across the communications channel. The control field contains the send-sequence number, the acknowledge number, and a code that specifies the type of frame. The poll-final bit is also used in this frame. The address field is fixed throughout.

Supervisory. S-frames contain the address and control field only, followed by the frame checksum. Unnumbered frames have the same format. The RR frame indicates that the data link is

ALL AT ONCE!

AND NEVER A "LOCKED OUT" USER!



1. Accounts Receivable Manager performs a customer query and has DataFlex print a report for each account with a balance over 60 days.

```
         APEX INDUSTRIES
  ACCOUNTS WITH 60 DAY BALANCES
                                        60 DAY
CUSTOMER  PHONE.       CONTACT          BALANCE
AJAX      305-555-1212 TOM MIX          1500 00
BEGOOD    904-435-8975 SUSAN ERICKSON   2245 50
CONTINENT 315-888-9090 WILLIAM STEVENS  3205 00
DOGWOOD   808-576-4532 ED DOUGLAS        903 75
```

2. Billing clerk makes change of billing address.

3. Sales Secretary receives change of phone number notice in the mail and accesses record to update the phone number field.

```
Apex Industries Customer Data
Customer Id: Acme
Customer Name: Acme Industries
Credit Rating: AA   Credit Limit: 25000
      Current Balance:     12500
      30 Day Balance:       4000
      60 Day Balance:       1500
      90 Day Balance:          0
Billing:
  Address: 2701 South Bayshore Drive
  City: Miami   State: FL  Zip: 33133
Shipping:
  Address: 913 Majorca Avenue
  City: Coral Gables   State: FL  Zip: 33134
  Phone: 305-856-7503   Contact: Gerald Green
```

4. Credit Manager receives latest D&B report on Acme and decides to increase their credit limit from $25,000 to $35,000 while posting the new credit rating.

5. Apex's salesman on the Acme account makes a sale and posts a transaction which updates the Current Balance field of Acme's record.

6. Advertising Promotion Director orders a mailing to the contact at each customer, merging contact name and address data with a word processor prepared document.

```
Gerald Green
Acme Industries
2701 South Bayshore Drive
Miami Florida 33133

Dear Mr Green

How would you like to earn an extra 5% discount on
every order placed with Apex Industries during the
months of July and August?

It's easy. Our new dealer incentive plan provides just
that opportunity, and all you have to do to earn your
extra 5%, Mr. Green, is to commit to purchasing
Apex products at a level at least 5% above Acme's
purchases during the same period last year. That's
all there is to it.
```

```
          Apex Industries Order Entry
Customer Id: Acme              Available Credit
Customer Name: Acme Industries

ITEM #   DESCRIPTION     QTY  PRICE      EXTENSION
8834     SILVER WIDGET   144  1.75          252.00
                              TOTAL         252.00
```

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Continued from page 50

ready to receive a new frame and acknowledges frames up to and including Frame_Acknowledge -1. The REJ frame is used to request retransmission of frames, starting with a frame numbered by the Frame_Acknowledge variable.

Additional frames may be transmitted after the requested frame. The receipt of an REJ causes a new state to occur, which requires the receipt of the requested I-frame to move back into the state from whence it came. When no more frames can be buffered because of queue limitations, the data link becomes busy and transmits an RNR frame. This causes a transition to the busy state, which can be cleared by receipt of an SABM, UA, RR, or REJ.

Unnumbered. The unnumbered frames are used to set up the link, disconnect the link, or cause a reset of the link to occur. This resetting is very important and is used to recover from hard errors or breakdown in communications. The SABM frame establishes the line or resets the line after an error not recoverable by resending occurs. The DISC frame is used to disconnect the data link when transmission is finished. This frame causes a transition to the original start state. To move from one state to another, the protocol machine uses the UA frame to acknowledge that a transition has occured.

The CMDR/FRMR frames are used to report a rejection condition not recoverable by retransmission of frames. This frame contains information that is useful in helping the other side know what is going on. It is the only frame other than the I-frame that contains information. Table 3 shows how this frame is constructed. We will not use this frame, except as a transition mechanism to move from one state to another and to reset the link and recover from the error.

The CMDR/FRMR frame is also used to report an invalid Frame_Acknowledge variable (pointing outside of the window) and an unimplemented command or response. The information field contains three bytes listing 1) the rejected control field of the frame causing the CMDR/FRMR, 2) the Next_Frame_To_Send contents, 3) the Frame_Expected contents, and 4) information stating whether or not the frame was a command or invalid response. The FRMR error is used also when an I-frame is received with an information field that exceeds the maximum.

Phases of X.25 balanced mode

Link set-up. The data link will indicate that it is able to set up a link by transmitting (having the physical link do it) contiguous flags (7EH). After receiving an SABM command, the data link will send a UA response and set all of its sequence and counter variables to zero. It then moves into the information transfer phase.

If the data link is needed to set up the link (from a request from the network layer), it would send an SABM and start a timer. Upon receipt of the UA response, it would set its sequence and counter variables to zero and move into the information transfer phase. If the timer expires before receiving a response, the data link will again send the SABM command. This will continue up to the preset maximum, after which some form of error recovery will have to take place at the level above (either session or application).

Information transfer phase. In this state, the data link may accept and transmit I-frames. When sending I-frames, Next_Frame_To_Send is increased by every frame sent. Frame_Expected is incremented after a frame is received with a sequence number equal to Frame_Expected. Both Next_Frame_To_Send and Frame_Expected are piggybacked onto an outgoing I-frame so that incoming frames can be acknowledged. If no outgoing frames are available, the data link will send an RR frame with the value of Frame_Expected in the control field. If the value of Next_Frame_To_Send is equal to Ack_Expected+7 (the maximum size of the window), the data link will not send any more frames until there is some acknowledgement of the frames it had previously sent.

If, in the information transfer phase, a situation arises where the data link cannot process any more frames (because of buffer limitations), a busy condition occurs. The data link may still transmit I-frames, but it will ignore the information field from any I-frames coming in, using the information in the control field to update the sequence and counter variables.

Reception of incorrect frames. When receiving a frame with an incorrect checksum, that frame will be ignored and nothing will be done to the sequence and counter variables. When the next frame comes (with a correct checksum), the sequence variables will

Table 2. Commands and responses used in balanced mode

			7	6	5	4	3	2	1	0
Format	Commands	Responses	Encoding							
Information transfer	I-Frame		-N(r)-			P	-N(s)-			0
Supervisory	RR	RR	-N(r)-			P/F	0	0	0	1
	RNR	RNR	-N(r)-			P/F	0	1	0	1
	REJ	REJ	-N(r)-			P/F	1	0	0	1
Unnumbered	SARM	DM	0	0	0	P/F	1	1	1	1
	SABM		0	0	1	P/F	1	1	1	1
	DISC		0	1	0	P/F	0	0	1	1
		UA	0	1	1	F	0	0	1	1
		CMDR								
		FRMR	1	0	0	F	0	1	1	1

RR = Receive Ready
RNR = Receive Not Ready
REJ = Reject
SARM = Set Asynchronous Response Mode (not implemented)
SABM = Set Asynchronous Balanced Mode
UA = Unnumbered Acknowledgement
CMDR = Command Reject
FRMR = Frame Reject
N(r) = Frame_Acknowledge
N(s) = Send_Sequence_Number

Table 3. CMDR/FRMR information field format

24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
0	0	0	0	W	X	Y	Z	-FR—EX-			F/R	-NFTS-			0	- control -							

W=set to 1 indicates invalid control field
X=set to 1 indicates incorrect length of S- or U-frame
Y=set to 1 indicates incorrect length of I-frame
Z=set to 1 indicates an invalid Frame_Acknowledge
F/R set to 1 indicates a command; 0 indicates a response
-FR_EX = Frame_Expected
-NFTS = Next_Frame_to_Send

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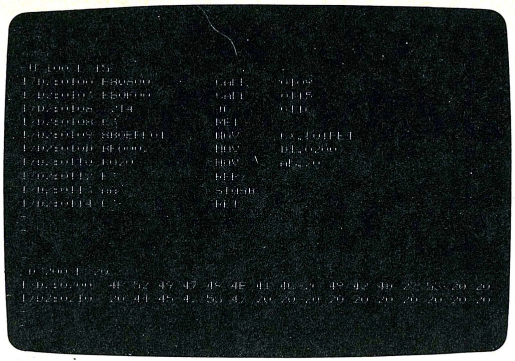
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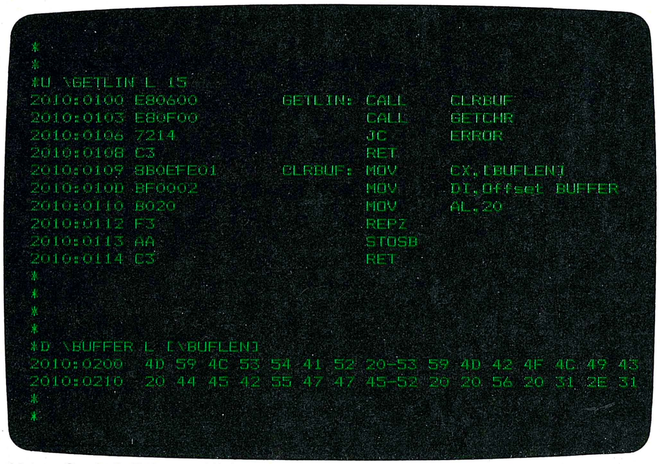
```
*
*
*U \GETLIN L 15
2010:0100 E80600        GETLIN: CALL    CLRBUF
2010:0103 E80F00                CALL    GETCHR
2010:0106 7214                  JC      ERROR
2010:0108 C3                    RET
2010:0109 8B0EFE01      CLRBUF: MOV     CX,[BUFLEN]
2010:010D BF0002                MOV     DI,Offset BUFFER
2010:0110 B020                  MOV     AL,20
2010:0112 F3                    REPZ
2010:0113 AA                    STOSB
2010:0114 C3                    RET
*
*
*
*
*D \BUFFER L [\BUFLEN]
2010:0200  4D 59 4C 53 54 41 52 20-53 59 4D 42 4F 4C 49 43
2010:0210  20 44 45 42 55 47 47 45-52 20 20 56 20 31 2E 31
*
*
```
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X.25 PROTOCOL

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not match, since the send-sequence variable will not match Frame_Expected. This event will result in a requeueing of the history buffer at the other communications link (remember, we have to keep track of all unacknowledged frames), and the requested I_frame will be sent, followed by whatever else needs to be sent in sequential order after the requested frame.

If the data link, when correctly receiving I- or S-frames, encounters a Frame_Acknowledge value greater than Ack_Expected, it will use that value to update counters and stop times. It performs this function even when in a busy or command reject condition. If, after the timer has been reset, there are still unacknowledged frames, the timer will be started again.

Receiving reject. When receiving an REJ S-frame, the data link will set its Next_Frame_To_Send variable equal to the value of Frame_Acknowledge. Since Frame_Acknowledge has been set by the other side equal to Expected_Frames, the data link should then be back in step with its counterpart downline.

Receiving receive not ready. When receiving the RNR S-frame, the data link will set its Next_Frame_To_Send equal to the Ack_Expected variable. It will then send the frame and start the timer. If the timer runs out, it will enter a timer-recovery state.

Link disconnect. The data link indicates that it wants to disconnect the line by sending a DISC U-frame and starting the timer. After receipt of a UA response, the data link returns to the disconnected state. Should the timer expire before receiving the UA, the data link will again transmit the DISC frame and start the timer. This will occur up to the preset limit, and then some form of error recovery will have to take place. When entering a disconnected phase after some error condition, the data link will transmit a DM U-frame. It will wait for the other side to send a SABM or DISC frame.

In conclusion

By now, you are probably wondering how to keep track of all that has happened, and what to do next. That's why it is important to design the data link in the form of a protocol state machine so that each state has a particular action sequence for each event that occurs. By maintaining a list of states in one table, and a list of events, action items, and new states in another table, you can not only keep track of what happens at every instant in time, but also the software becomes infinitely easier to understand and debug.

If, by chance, we have misinterpreted the specifications, we can simply change the action items to better serve the events that have taken place, or change the next state that the machine would enter into. By covering all our bases, we can ensure a reliable and efficient method of communication.

To be continued. Part II of this series will show how the protocol machine can be implemented in software and how the table of states, events, actions, and new states can be drawn into a simple, yet powerful algorithm.

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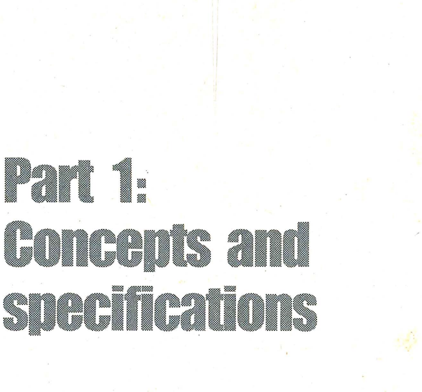
RCPM and RPC Systems: An Overview

Part 1: Concepts and specifications



by Dr. Electric

So you just bought a shiny new modem for your CP/M computer, and now you're wondering what to do with it! Well, you're in luck, because there's a whole world out there just waiting for you.

Background

On February 16, 1978, Ward Christensen and Randy Suess started the Chicago CBBS (Computerized Bulletin Board System) as a way for local computer hobbyists to leave messages for each other. Within this message system was a secret feature used in conjunction with a program called MODEM (written by Ward). It enabled CP/M computers calling the CBBS to send files back and forth. This file transfer capability of CBBS was initially known only by Ward and Randy and later a by few others, but it was there, making this the first remote-access CP/M computer network with a public message system and file transfer capabilities. Later, Ward took out the MODEM support because of problems in keeping the system going with only 70K disks on his North Star.

The CBBS message system, written entirely in 8080 assembly language, was sold to several other computer enthusiasts, and this started several offshoots of CBBS. Keith Petersen wrote a special remote-access version of MODEM called XMODEM, and set it up on his Royal Oak MINICBBS in the Detroit area—probably the first fully public CP/M software exchange system. Tom "C" also set up his CCCC (Calamity Cliffs Computer Club) system in Lake Forest, Illinois so that the file transfer option was public.

About the same time as the first CBBS systems were starting up, Kelly Smith's CP/M-Net system was set up in Simi Valley, CA with an XMODEM-type program called SENDME. Dave Jaffe wrote a program called BYE that enabled a CP/M computer equipped with a modem to be controlled by a remote system. Howard Moulton translated an SJBBS message system written in Xitan Basic to a more transportable version written in Microsoft Basic called RBBS. These people and many other experienced programmers began writing various CP/M programs that they contributed to the public domain via the bulletin boards. Thus developed what are today called RCPM (Remote CP/M) software exchange systems.

As of July 1983, there were over 100 RCPM software exchange systems in the United States, and several in Canada, England, and even Australia. Most of these systems are public and are available for use at no charge, or for the price of a phone call. They have *lots* of public domain software online that you can use if you have a CP/M computer. All you need is a modem and a MODEM program that will allow you to access RCPM systems and download the software to your computer.

What your modem program does

What's the catch? First of all, your modem program has to do more than just allow you to type text into a remote system. It needs to have a file transfer facility that will enable you to have the remote system send files to you (download), or to have the remote system receive files from you (upload). On RCPM systems, the de facto standard method for transferring files is through the use of XMODEM, which uses a special protocol often named for its originator, Ward Christensen.

The Christensen protocol is a very error-free way to transfer any kind of CP/M file, including .COM files and "squeezed" files (more on "squeezed" later). It can be used over standard dial-up lines, as it has special error-detection handshaking built in to ensure the accurate transfer of data.

Without getting too technical, this program works by dividing up the file to be sent into sectors (128 bytes each), sent one at a time. Each sector sent is preceded by a Start-of-Header (SOH) character and two sector-number bytes, and followed by a single checksum byte or two Cyclic-Redundancy Check (CRC) bytes. The checksum or CRC is produced on the transmitting end and sent along with the data. At the receiving end, the checksum/CRC is computed on the received data and compared against the received checksum/CRC value. If the computed value disgrees with the received value, it indicates that a transmission error has occurred, and the receiving system returns a NAK (Negative Acknowledgement) to request that the sector be retransmitted. If the received and computed checksum/CRC agree, the received sector is saved in memory or on disk and is then acknowledged with an ACK character. For a given sector, the receiving system makes no more than 10-15 (the number can be adjusted) requests for retransmission, and will then give up. This happens only under very noisy line conditions, or when the line becomes disconnected during a transfer operation.

The checksum method is not as accurate as the CRC method but is easier to implement, and is therefore still hanging on as an alternative to CRC. The CRC method used is the CCITT CRC-16 standard, which is also used by other block mode protocols, such as SDLC, HDLC, and BISYNC. CRCs are also used on floppy disks to ensure the validity of recorded data.

Installing the program

How do you get a modem program up and running on your computer? Luckily, you don't have to reinvent the wheel, as there are many different modem programs out there for various types of computers, and you can probably get a disk copy of the one you need through a local users group meeting. If you can't get it in your disk format, here a special receive-only, checksum-only modem program called MBOOT that will allow you to receive a more full-fledged modem program over the phone. (Look for MBOOT.DOC to describe how to get MBOOT up and running.) The hard part occurs if you have a nonstandard system for which no equates are available in any of the public domain modem programs. If this is the case, then you'll have to do a little homework to find out the proper port addresses and status register values, and modify a copy of MBOOT or a MODEM program for your system.

Without RCPMs we'd be reinventing the wheel over and over again.

A number of commercial telecommunication programs also support the Christensen protocol (XMODEM/MODEM7), but some do *not*. Copyrighted programs that are rumored to support the Christensen protocol include: SUPRTERM (for the KayPro II, 4 and 10); AMCALL (for the Osborne 1); ASCOM and COMMX (for S-100 CP/M systems and others).

Logging on

So, assuming you have a modem and a modem program, you're ready to connect with an RCPM system to check out the world of public domain software. How do you do it? Well, to begin with, you'll need a phone number for an RCPM system, preferably a local one to keep your phone bill from getting too big. A current listing of all known operating RCPM systems follows this article and can be used to get the phone number and access information for an RCPM system in area. You should start your modem program and then call this computer if you are manually originating a call, and wait for it to answer and send you a carrier tone. When you hear the carrier tone, place the phone handset in the modem if you are using an acoustic coupler or wait for your modem to respond if it is direct connected. Once you are connected, enter terminal mode (MBOOT comes up in terminal mode by default, MODEM7 and others use a "T" command to enter terminal mode) and log on to the remote system. You may want to enter terminal mode before you connect in order to send dial commands to your auto-dialer, if you have a "smart" modem.

Unfortunately, RCPMs have many different log-on procedures, so the steps I outline here may not apply to the system you call. This should, nevertheless, give you an idea of what to do. On most RCPMs, you will first have to enter several carriage returns until you get a message or question from the system. (Carriage returns are used by many RCPMs to set the baud rate automatically to match whatever you have.) On most systems, the first question asked is "HOW MANY NULLS DO YOU NEED?" This question is mainly for hard-copy terminals that tend to lose characters at the beginning of every line during carriage return. If you are using a CRT or printing terminal with buffering, chances are you won't need any nulls, so specify O. If you are losing characters at the beginning of every line, then hang up, call the system back, and ask for more nulls.

Many RCPMs will next ask you "CAN YOUR TERMINAL DISPLAY LOWER CASE?" Answer "Y" if lower-case characters can be displayed on your system console or terminal, or "N" if you want all lower-case letters converted to upper case by the RCPM before they are transmitted to your system.

Some systems may also ask "DO YOU NEED LINEFEEDS?" If your system automatically adds linefeeds to carriage returns (TRS-80 does, for example), then answer "N"; otherwise answer "Y". If you answer "Y" and everything is double spaced, remember to answer "N" next time.

After answering these first questions, you will usually see a welcome message and/or display of bulletins—*read* these, as they will usually have information that may help you later on. After the bulletins, you will probably be

RCPMs

Continued from page 57

asked your first and last name and, if it's your first call to the system, the city and state you are calling from. Some systems, such as Kelly Smith's CP/M-Net system, do not ask you for any log-on information at all, but simply drop you right away into CP/M.

Using the remote system

After logging on, you will probably get a menu of functions that can be used within the message system. Most RCPMs have a bulletin board program such as RBBS or CBBS that performs the log-in and allows users to leave messages for each other and/or the sysop. Check the functions to see which will get you to CP/M. On my system, for example, the "C" function will get you to CP/M; on others, "G" will do it. Then select this function to exit the message system and enter CP/M.

Under CP/M, you can usually use DIR, FILEFIND, WHATSNEW, SD, or some other DIR program to see the files available on the system for downloading. Some systems will have a HELP.COM file available on-line or a THIS-SYS.DOC file that you can TYPE for more information. After you find a program you are interested in, you can usually use TYPE or TYPESQ to check it out to see if you really want it, and then use XMODEM to download it. Be sure to read comments and help messages on the system to which you are connected, as syntax can vary from one XMODEM version to another. Usually, however, the syntax is: "XMODEM S filename.typ", where "filename.typ" is the name of the file you wish to download. After locating a file and starting XMODEM, you must then tell your modem program to exit terminal mode and get ready to receive a file. Usually, this is an "R filename.typ" command. If all goes well, you should see some kind of messages from your modem program as each sector is transferred across to your system.

If you have any problems, check to make sure that your communications interface or UART is set up for 8 bits, no parity, and 1 stop bit. If you have this set-up and your modem program can properly send and receive data in terminal mode, then it *should* work in file-transfer mode as well. Make sure you use checksum mode if your program doesn't support CRC mode. When downloading, you don't need to know which your program uses, but if you have a choice, use CRC mode. When uploading, some versions of XMODEM use R to specify receive with CRC mode and RC for checksum mode; others use RC for CRC mode and R for checksum mode. Type XMODEM without any option or filename, and it will probably give you some syntax help message.

Depending on the modem program you are using, data will usually be received into memory first and then written to disk. Most modem programs will store 16 sectors in memory before writing to disk. After the file is completely transferred, it will be closed and you will get a message to that effect. In some cases, you will be dumped back into terminal mode; in others, you will exit the modem program and will be in local mode. If you end up in local mode, be sure to reconnect, using your modem program's terminal mode, and then disconnect from the remote system, usually by using BYE, when you are done.

On RCPMs the de facto standard for transferring files is through the XMODEM.

A note of filetypes (the three characters on the end of the CP/M filename after the period): most XMODEMs are set up so that you cannot transfer a file with the .COM extension. Therefore, sysops usually rename .COM files that are available for downloading to .OBJ. When you download such a file, use a .COM extension for the filename to be saved on your disk.

Most .OBJ programs are written so that they use the standard CP/M system calls and are therefore runnable without change on *most* CP/M systems. Notable exceptions include MODEM programs (CP/M has no standard system calls for modem I/O), BYE, XMODEM and other hardware-specific programs. Filenames with .ASM and .MAC filetypes are assembly-language source programs. Filetypes such as .BAS indicate Basic source files, .DOC files are documentation, .C files are C source files, etc. Filetypes are also used as part of a filename, as in "34MBRCPM.NEW". (**Note:** *If the middle character of the file type is a "Q", as in "RCPM-039.LQT", it usually means that the file is squeezed. See below for information on USQ.)*

What to download

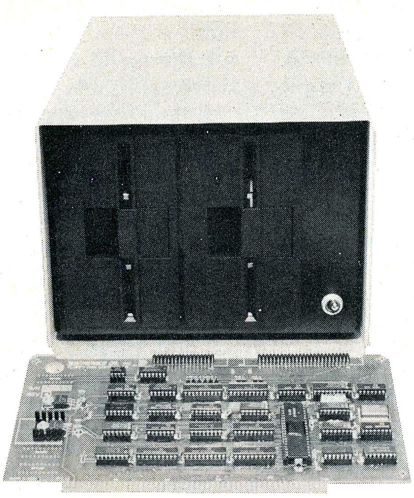
What kinds of public domain software should you get? Well, that depends on your particular requirements, but there are several general-purpose utilities that you will *need* and others that would be really nice to have.

Two of the very first programs you should get are SQ.COM (SQ.OBJ) and USQ.COM (USQ.OBJ), written in C by Dick Greenlaw. These programs are borrowed from the UNIX environment, but will run without change on most standard CP/M systems. SQ allows you to condense a file in order to reduce both the amount of disk space required to store it to or from another system.

You'll need USQ, its companion, to unsqueeze files that you download from RCPMs, as many systems use SQ extensively to save disk space and transfer time. Two other useful companion programs are TYPESQ, which allows you to view squeezed files directly on your console without using USQ first, and PRINTSQ, which will unsqueeze a file directly to the printer. Look for SQUEEZER.DOC or SQUEEZER-.DQC to explain how SQ and USQ work.

Another public domain program I consider a must is FINDBAD. FINDBAD allows you to check a newly formatted blank disk or a disk with files to verify that all sectors are readable. It reads all of the disk sectors, and any that it finds unreadable are locked out by being included in a file named [UNUSED].BAD. I use this after formatting my disks to lock out any bad sectors, and I almost totally avoid the dreaded "BDOS ERROR ON A: BAD SECTOR" error message. *(Note: FINDBAD version 5.4 and later will work on any CP/M 2.2 system, as long as the READ SECTOR routine in the BIOS returns to BDOS with register A = 0 if no error, 1 if error. The BIOS will sometimes bomb out and not return to BDOS; these systems won't work with FINDBAD. On most systems, however, it works like a charm.)*

LU, a very useful program written by Gary Novosielski, is a library utility used to combine related files (such as MODEM798.AQM and MODEM798-.DQC, for example) into a single .LBR file. Like SQ, it is also used by sysops to save disk space/transfer time. LU will also extract files from a .LBR file, as will the "L" option on some version of XMODEM if you don't want to download the whole .LBR file. Related LU utilities include LDIR, which lists the member files of a given library; LTYPE, which types a selected file within a .LBR file; and LRUN, which runs a selected .COM file within an .LBR file.



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CIRCLE 123 ON READER SERVICE CARD

RCPMs

Continued from page 58

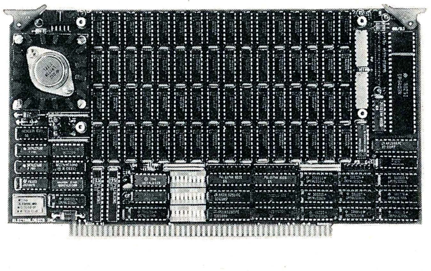
There are *many* different directory programs out there to replace the version that Digital Research provides for CP/M, but my personal favorite at present is SD by David Boruff. The latest version is 4.8, I think, but now I'm working on a new version with a few more goodies. SD allows you not only to get a directory of your current disk and user number, but also to automatically scan all available disk and user areas. It will also show $SYS files as well if you want it to. It sorts the files in alphabetical order and shows the file sizes in 1K increments, as well as giving a summary of the total disk space listed and available. Version 4.8 also has a $L option that lists the contents of any .LBR files encountered. The amazing thing is, it does all this with a .COM file of only 3K! Look for a copy of the .DOC or .DQC file for whatever version you find and read it for a description of all the options.

On many RCPMs, such as my own, the sysop has poked out the standard .DIR utility so that SD, or whatever favorite DIR program the sysop likes can be named DIR.COM. This allows people to type .DIR instead of SD to get the delux version. Typing "DIR A: $U0ADL" on my system, for example, will show you all available files in all user areas on all disks, and will also list the contents of any library files encountered!

On RCPMs there are many experienced users who can help you.

Naturally, you'll want a good modem program. If you had to start with MBOOT, you would need one right away so that you would have CRC capability and could upload as well as download. There are 97 million versions of MODEM7, MODEM220, MODEM798, SMODEM, etc., out there, some of which are very machine specific and others that are more general. Most of them will require some kind of installation procedure, but if you get your first modem program working, and have the source code for it and any new version you want to install, you'll have what you need to get the new version working—provided it's general enough. Be sure to get the .DOC or .DQC file that goes with the version you pick up and *read* it; modem programs usually differ in many ways and have different features.

A few more general-purpose utilities to look for: DU, a disk utility that lets you read and write to any sector and change it in any way you want; UNERA, a handy lifesaver that can recover files you accidentally ERA'd; DIF, another utility from UNIX that compares two text files; SSED, the companion utility to DIF that can take the antecedent file, plus a .DIF file created by DIF, and make an updated version; CAT and NEWCAT, which allow you to keep track of where your files are on all your various disks; RESOURCE, which will allow you to reassemble the source for an 8080 object file; SPELL, a poor-man's spelling checker; and many other utilities as well.



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QUASI-DISK price includes the most extensive software package available.

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- 2 print spoolers (fixed 64K + dynamic capacity).
- Includes software drivers for CP/M80*, CP/M86*, and TurboDOS***, with Zenith Z-100** coming soon.
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Customer support begins with a 1 year warranty. Should your board fail, we will send you a replacement board at our expense. Extended warranty option available.
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Arizona 85260. 1-800-528-3138.

Microprocessors Unlimited,
Route #1, Box 260, Beggs,
Oklahoma 74421. 1-918-267-4961.

Lamron Pty.,
20 Stamford Ave., Ermington, NSW,
2115 Australia. 02-85-6228.

CIRCLE 57 ON READER SERVICE CARD

If your system is Z80 based, for the ultimate CP/M system, you can get ZCPR2, a public domain replacement for the standard CP/M console command parser (CCP) written by Richard Conn (*Microsystems*, June 1983). ZCPR2 gives your system a few added features over standard CP/M, such as named directories (e.g., Paul: instead of B:); user-definable search path (used to allow ZCPR2 to look in more than the current disk/user area for a .COM file); multicommand lines; redirectable I/O; and a comprehensive set of utilities that will work in concert with ZCPR2. This set of programs *can* be picked up from RCPMs, but since it is so large, you should try to get it on disk.

One more note on ZCPR2. Unless you can get a version already set up for your particular system, you may have problems installing it unless you are very adept at assembly-language systems programming and have a copy of your system's BIOS. This is because ZCPR2 requires a rewrite of the cold boot routine in the BIOS in order to implement all of its advanced features. ZCPR version 1 is also available; it lacks many of the advanced features of ZCPR2, but is much easier to install because no BIOS changes are necessary.

Other goodies you may want to get include games such as CHESS, ADVENTURE, STARTREK, ALIENS, etc.; source files; various .DOC files (you can learn a lot by reading them); and, of course, you should always get a copy of the latest listing of RCPM systems, usually named RCPM-nnn.LQT, where "nnn" is the version number. RCPM-039.LQT is the version included below, and, yes, it's a squeezed file. If you keep up with the updates (currently done once a month) and have SSED, you can get the .DQF file (a squeezed .DIF file) and use it to update your list. RCPMoonn.DQF, where "oo" is the old version number, and "nn" is the new version number, will be the file to get; get RCPMLIST.DQC for information on how to use it with SSED to update your list.

Good manners

Most systems have security measures that have been implemented to discourage irresponsible users from wreaking havoc on RCPM systems. Unless careful use is made of these systems, they will not be around for future generations.

Your participation in the RCPM network will be much appreciated if you remember that contributions from users are the only way that RCPMs get software to distribute, and it is hoped that most users will upload as well as download. If you find a good file on an obscure system somewhere, don't forget to pass it along to another RCPM. If you develop a new program that others might appreciate, write a .DOC file for it, and upload the program and documentation to an RCPM. Public domain software is a valuable resource that we should all try to contribute to, as well as benefit from.

Sifting to find public domain gold isn't easy, but it's worth it.

Feel free to address questions you have on particular problems to ALL. There are many experienced users out there who can help you, in addition to the sysop, who can also be of assistance. Try to read all of the bulletins, messages, and .DOC files you can before asking for help. You just might find the answer yourself. Use TYPE to read .DOC files, TYPE or TYPESQ to view .DQC files, and LTYPE to read .DOC/.DQC files contained within a .LBR file. Many systems will respond to HELP, but Control-C will usually exit HELP.

If you need online, person-to-person help, you can usually use a program called CHAT under CP/M to talk with the sysop, or you can use a semicolon at the beginning of a CP/M command line to send comments to the sysop if you know he or she is there. If you leave out the semicolon, CP/M will look for a .COM file when you hit return. Should the sysop not respond to CHAT or to your comments typed at the CP/M prompt, reenter the message system and leave a message there for ALL or SYSOP. Comments typed at the CP/M prompt or in CHAT are not saved.

Keep in mind, when asking for help, that sysops usually receive similar requests many times a day, and if they seem to ignore you, it's because they cannot always answer your question right away. A lot of sysops are part-time volunteers and may not even check in for a couple of days. If you do your

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CIRCLE 62 ON READER SERVICE CARD

RCPMs

Continued from page 61

homework and ask intelligent questions, however, I think you will discover that most sysops will try to help you sooner of later.

On most RCPMs, you log off the system by typing BYE and a return as a CP/M command line. Additionally, some BBS will allow direct log-off from the message system. This runs a program called BYE.COM that will hang up the phone and reset the system for the next caller. Before disconnection on some systems, you will be asked if you have any comments. If you answer "Y," you can enter comments that are readable only by the sysop.

Of the hundreds of public domain programs out there, there are some really good ones and some really bad ones. Sifting through to find the gold isn't always easy, but it's worth it. Getting the latest and/or the best version of software is difficult, especially due to the fact that many people will be working on updates to the same program at the same time, and will come out with different code with the same version number. Even so, if you ask around, you will usually find people who have this or that version that works well, and you can get help from your local users group or RCPM if you have problems with a particular program.

RCPMs are for the exchange of public domain software only; copyrighted software should not be uploaded for distribution on any RCPM system. There are some pirate BBS who do this, but I do not condone this practice, and most of the pirates get in trouble with software companies sooner or later.

Setting up your own station

If you want to set up on RCPM, you will need a copy of BYE that is set up for your machine and a BBS program such as, RBBS, OXGATE, CP/M-Net, etc. BBS is optional, but either a BBS or a log-on program is highly recommended. A copy of XMODEM set up for your system is also necessary. In addition, you will want to poke your operating system or set up ZCPR2 in order to eliminate such commands as ERA, REN, and TYPE from the system. TYPE will show $SYS files but won't print out squeezed files. I use TYPE14 for TYPE.COM, which doesn't show $SYS files, but does unsqueeze squeezed files automatically. Programs such as these should be used to ensure security.

In addition to BYE, a BBS program, and XMODEM, you should probably have CHAT, HELP, and a few other .COM files on line for people to use as well as object files, source files, and documentation available for all the software whenever possible, and watch out for uploads and/or messages filling up your system. Be prepared to answer a lot of questions from new users, as they will usually assume that you know something if you are a sysop.

For more information on public domain software and/or a copy of a modem program to get you started (if you have 8" SSSD IBM standard disks), contact either: **CPMUG**, (CP/M User's Group), *1651 3 Ave., New York, NY 10028;* or **SIG/M**, (Special Interest Group/Microcomputers of ACGNJ—Amateur Computer Group of New Jersey), *Box 97, Iselin, NJ 08830.*

RCPMs are a real benefit to CP/M users everywhere. Without them, we'd be reinventing the wheel over and over again. Thanks to Ward Christensen and the many others who have contributed to public domain software, we can add flexibility and power to our systems. In fact, many public domain utilities are not available in copyrighted versions. Even Digital Research has benefited from public domain software—their new CP/M Plus has a few features that ZCPR1 had! ◼

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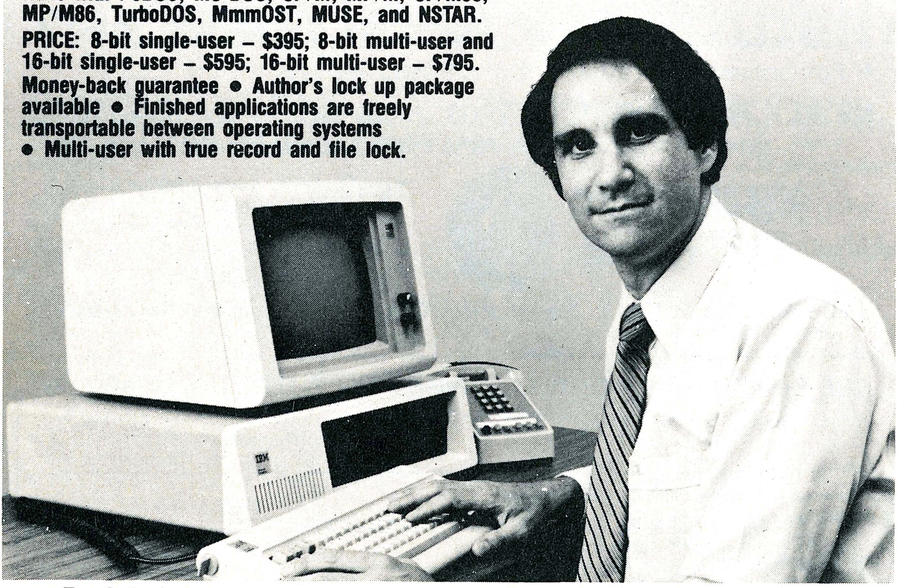

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- Maximum of 32,767 rows per file;
- Maximum of 400 characters per row, and 40 columns per table;
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- Sorting, copying, merging, and reducing routines;
- Mailing label program;
- Reporting program generates reports with control breaks, totals and subtotals, and selects rows by field value; many other reporting features;
- Cross-tabulation, correlations, and multiple regression;
- Video-display-handling module;
- Disk-file-handling module.

Many other features. UCSD formats only.

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A terminal emulation program for communication between computers of any size.

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The Text Processing Language. A text-file runoff program consisting of a set of text-processing primitive commands from which more complex commands (macros) can be built (as in Logo). Features include:

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- Adapts to any printer;
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- Text justification and centering;
- Indexing and tables of contents;
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- Bolding and underlining;
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- End notes and footnotes;
- Widow and orphan suppression;
- Floating tables and 'keeps.'

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Full-screen text editor; designed to be used either with TPL or by itself.

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Planimetry program:

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- Multiple files;
- Dynamic memory allocation for RAM-resident index and current "page" of entries;
- Includes demonstration program and testbed program.

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Chromatography data analysis program:

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CIRCLE 52 ON READER SERVICE CARD

A Directory of Remote CP/M and PC Software Exchange Systems

Consult this Directory for the RCPM Systems in your area

Revision by Jud Newell
April 18, 1984

Remote CP/M Software Exchange Systems List #49

04/18/84 revision
by Jud Newell

A summary of RCPM software exchange systems using Christensen protocol (XMODEM) for file transfers, available to the general public for the exchange of public domain software.

> *SPECIAL NOTICE TO SYSOPS: Please inform Kim, Jud or Steve of any changes in your system to avoid being removed from the list, which is verified periodically.*

Send update information (see file NEWSYS.OPS on most RCP/M Systems for required details.) to:

Kim Levitt
MBBS HEADQUARTERS RCP/M. (213) 653-6398. [Leave msg on MBBS and/or upload file using XMODEM]

or

Jud Newell
TORONTO RCP/M SYSTEMS. (416) 232-0442, (416) 232-0269, (416) 231-1262, (416) 231-0538. [Leave comments on exiting system]

or

Steve Sanders
PRO-COM DATABASE. (813) 937-3608. [Leave comments on exiting system]

Systems are 24 hours, 7 days with no callback unless local times of operation are listed after sysop's name. Callback systems have a "cb" before phone number.

Systems charging fees have a dollar sign "$" after phone number. Some systems may restrict "first-time" users; be sure to read the opening info files when accessing a new system.

Baud Rates: (PMMI=1-7) / 1=110 / 3=300 / 4=450 / 6=600 / 7=710
B=Bell 212A 1200 / V=Vadic 1200

Disk Capacity: K=Kilobytes / M=Megabytes

Additional Notes:

1. Call-back systems are those where a computer and real people share the same telephone line. To contact the people, just dial & let the phone ring until you get an answer. To contact the computer: (1) dial, (2) let the phone ring once, (3) hang up just before the 2nd ring, & (4) re-dial.

2. Note that the 212A/Vadic 1200 baud modems may not be compatible with yours. Some systems use Vadic 3451 Triple modems, compatible with both Bell and Vadic standards. Sign on the first time at 300 baud to determine the system capabilities. PMMIs can sometimes be used over 300 baud with 1200 baud systems. PMMI baud rates are: 110, 300, 450, 600, 710 and are indicated above as "1-7".

3. Use of an alternative long-distance service should be considered when planning to transfer long programs. Charges on ITT Longer Distance, MCI, Sprint and Western Union are 50-60% of AT & T's regular long distance rates. Such services are available in many areas of the country and many of them can now call anywhere in the U.S. They work fine at 300 and 1200 baud most of the time.

4. All times listed are local *time, please observe operating hours for systems with scheduled availability.*

THE DIRECTORY

Northeast

Connecticut

Xerox East RCP/M RBBS. (203) 232-3180. Dave Shefelbine; (3B;10M); General Interest and Xerox 820-II programs. (Hartford)

Connecticut Micro Decision UG. (203) 445-5019. Steven Landers; (3;800K). CP/M Software, CPMUG, Osborne, Morrow technical help

Maine

Programmer's Anonymous RCP/M. (207) 839-2337. Ralph Trynor; (3B;180K); Osborne Software; (Gorham)

Massachusetts

BINEX Boston Information Exchange. (617) 423-6985. Glenn Meader, Andrew Moore; (3B;10M). M-TREE Message System

Andover Cnode. (617) 470-2548. Layne DuBose; (1-7;18M); All C User's Group volumes on-line, plus best of CPMUG. Also some Osborne, RS M100, 8088/8086 software; (Andover)

Milford S-100 User's System. (617) 478-6062. Howard Moulton, Jr.; (no answer when in use); (3B;1.1M); access password = "PDBIN" (must be upper case only); IMSAI S-100 w/Z80;

Bellingham RBBS. (617) 966-0416. Jim Devoid; (no answer when in use); (3;180K); Heath H8 system

New York

C U R A RCP/M. (212) 625-5931. Brian Callahan; (3B;10M); Kaypro, Osborne, Zram, Softbox; (Fort Greene, Brooklyn)

Remote CP/M Facility of Dolgeville, NY. cb (315) 429-8185. Peter A. Polansky; (346B;500K); 8086, 68000; (Upstate NY)

CNY Technical RCP/M. (315) 437-4890. Mark Howard; 5P-8A M-F, 24 hrs wknd (3B;52M); now 1200 capable; CP/M Plus Users' Group (CP-PLUG) host system; Also Apple and Kaypro applications; Technical assistance RBBS. (Syracuse)

Connection-80 TPM (RTPM). (516) 567-8267. Tom Vande-Stouwe; (3B;20M); Epson QX-10 and Osborne software (FOG Library on line); also the message base for the Long Island Osborne Network; (Long Island)

Connection-80 TPM (RTPM). (516) 567-8995. Tom Vande-Stouwe; 6P-9A; (3B;20M); (Long Island)

Mid-Suffolk RCP/M. (516) 751-5639. Al Klein; 5P-9A daily, 24 hours weekends;(3B;5M); Telecom, utilities, Apple, IBM-PC, Kaypro (Long Island)

Johnson City, NY SJBBS. (607) 797-6416. Charles; Eves, etc.; (3;2M); (Upstate NY)

Bearsville Town SJBBS. (914) 679-6559. Hank Szyszka; (1-7;4M); (Upstate NY)

Woodstock RCP/M RBBS. (914) 679-8734. John Doak; (134B;4.8M); (answers after 3rd ring), CP/M, RCP/M, and some Osborne software available.

S.D.V. RBBS RCP/M. (914) 769-2970. Richie Cawley; (3B;20M); Logical Drives A-F, user areas 0-5 available. (Osborne 1 w/external 20MB disk.) (Downstate NY)

Ontario, Canada

Willowdale CBBS. (416) 226-9260 $. Vic Kass; (3BV;50M); SIG/M, CP/M UG Library; (Toronto)

Toronto Ontario RCP/M Systems. (416) 232-0442 232-0269 231-1262 $. 231-0538, 232-1449 Jud Newell; (3BV;71M); allow limited access w/o registration; (5 systems available); (Systems 1-3,5 for CP/ users, System 4 for IBM PC users, System 3 is a Kaypro network system); Annual $30 fee allows access to all.

These systems are also collection points for updates to this list. Please send the information as a comment on leaving system. (SYSOPS: See NEW-SYS.OPS for information on obtaining access to these systems at no charge.)

E-MX RCP/M. (416) 484-9663. Simon Ewins; (3B;360K); Osborne Software. Distribution point for e-mx mail system series of programs.(Toronto)

Quebec, Canada

Montreal RCP/M. (514) 481-6329. Pierre Benard; M-F 6P-8A, wknd 24 hrs; (3;1M)

Rhode Island

Providence RCP/M. cb (401) 751-5025. Mark Rippe; 10A Sat-10P Sun; (3;1.2M); Msg system down

East Central

Maryland

Cambridge, Maryland RBBS/RCPM. (301) 228-4621. Al Waller; (3;5M); Software Exchange,Ham Radio, Communications; (Maryland's Eastern Shore)

Pikesville RBBS/RCPM. (301) 484-2831. John Madill; (3?;??); DEC, Rainbow, IBM-PC; Sponsored by local Computerland store; (Baltimore)

BHEC RBBS/RCPM. (301) 661-2175. Walt Jung, Charlie Schnepf, Harry Barley; (34B;10M); (Baltimore)

Baltimore Heath Users Group (BHUG). (301) 768-1499. Allan McClure/Ricky Litofsky (34B;3M) If no answer after 2nd ring, system is down for maintenance. (Baltimore)

St. Mary's College RCP/M. (301) 863-7165. Jonathan Crawford; (3B;20M); Epson QX10 system; Features special interest sections for different computers, educational programs; (St. Mary's City)

Microcomputer Electronic Information Exchange. (301) 948-5718. John Junod, Lynne Rosenthal; (3;64K); (Gaithersburg)

New Jersey

CP/M-NET™ EAST [the only one]. (201) 249-0691 IMSW. (SYSOP's = Harry & Al); (3B*;40M); Otrona, S-100, Kaypro, DEC, IBM , Osborne, Apple; Modem PGM's, Sig/m, CP/Mug, Cug, Utilities, etc.; When database is full, the system will take new callers at 1200 baud only! (Piscataway, NJ)

RIBBS of Cranford, New Jersey. (201) 272-1874. Bruce Ratoff; (1-7,B on request;3M); bulletin board of SIG/M, (Special Interest Group/Microcomputers, ACGNJ)

KUGNJ1 RBBS Atlantic Highlands, NJ. (201) 291-8319. George Frankle; (3B;400K,(10M soon)); RBBS of Kaypro User Group of New Jersey; (Password="KUGNJ1"); (Atlantic Highlands, NJ)

Flanders, NJ RCPM. (201) 584-9227. Ken Stritzel; (3B,1-7 on request;26M) Latest SIG/M releases

The C-Line. (201) 625-1797. David Fiedler; M-F 8P-9A, wknd 24 hrs; (1-7;2M); UNIX/UNIX-like systems, C software; (Northwest NJ)

Metroplex RCP/M. (201) 722-8297. Steve Holtzclaw; (3B;20M); Newly relocated from Dallas; Latest SIG/M-CPMUG releases; (Somerville)

Paul Bogdanovich's RBBS. (201) 747-7301. Paul Bogdanovich; M-F 6P-11P, wknd 8A-11P; (1-7;1M)

Pennsylvania

Allentown RBBS/RCPM System. (215) 398-3937. Bill Earnest; (1-7BV;10M)

Compusers RCP/M/BBS. (215) 666-5381. Mark Rodenhausen, George Ligowski; (3B;10M) Part of Compusers Users Group of Valley Forge, PA. (Valley Forge)

ChurchBoard BBS. (215) 932-8829. Byl Levering; (3B;??); Church related messages

Greensburg RBBS-RCP/M. (412) 836-8407. Doug Borko; (3;??); Kaypro related files; (Greensburg)

State College, PA. CUG-NODE. (814) 238-4857. Joe Shannon; (3;3M)

Virginia

Arlington RCPM/DBBS of Virginia. (703) 536-3769 $. Eliot Ramey; M-F 10P-3P, wknd random; (1-7;800K); (Washington DC area); (Minimum $5.00 subscription fee.)

Springfield RCP/M. (703) 644-2299. Roger Donais; (3B;10M), Kaypro, Osborne, Morrow Interests

The Flying Circus RCP/M. (703) 759-6627. Mike Levy; (3B;10M); Interest in Kaypro; SIG/M CPMUG (Great Falls)

OxGate-007 Grafton VA. (804) 898-7493. Dave Holmes; (1-7;5.2M); CP/M, TRS-80 & Apple software; (Tidewater)

Midwest

Illinois

Logan Square RCPM. (312) 252-2136. Earl Bockenfeld; (1-7;1M); Special interest databases. Daily change on B; (Chicago)

RCPM PLUS. (312) 326-4392. Dick Lieber; (3B;??M); ????

Palatine RCPM. (312) 359-8080. Tim Cannon; (3B;4.8M); Disks on B, C & D are changed daily; (Chicago area)

Xerox Midwest RCPM/RBBS. (312) 384-0013. David Lowy; (12A-6P, other hrs no answer if in use); (3B;980K); Mainly for Xerox PC users, but all welcome. Password required for system access; (Xerox 820-II system); (Chicago)

C.A.S.A.T. CBBS. (312) 443-3744. John Manning; (3;2.5M); Art, sound synthesis, video, analog & digital image processing, telecommunications, robotics; Located at the Center for Advanced Studies in Art and Technology at the School of the Art Institute of Chicago, this CBBS has been created to promote exchange between artists and all interested parties in the use of technology in art.; (Chicago)

Glen Ellyn West Suburban RCP/M. (312) 469-2597. Jim Mills; (36B;3.6M); (Chicago area)

Prairie View RCP/M. (312) 537-7888. Don Castella; 6P-8A Mon-Fri, 24 hrs wknd; (1-6B;3.6M) Heath H89 3 sets of disks changed daily (Chicago area)

AIMS, Hinsdale, Ill. (312) 789-0499. Mark Pulver; (1-7B;10M); Running both PMMI and Hayes 1200 modems, 1200 detect at second c/r then 3 sec delay to switch modems. (Chicago)

Chicago RCP/M. (312) 941-0049. John Sojak; (3B;35M); Running both PMMI and 1200 Baud (Chicago)

Indiana

Bloomington RCPM/RBBS. (812) 334-0609. Bob Jacobs; (3B;2M); (four carriage returns to bring up sys); current public domain software, amateur radio (satellite).

Kansas

Wichita RBBS/RCPM. (316) 682-9093. George Winters; (8P Fri-11P Sun); (3B;300K); member of FOG OPEK (Osborne Portable Enthusiasts of Kansas) chapter.

Mission, KA RCPM. (913) 362-9583. Bill Parrott; (3B;7M); Heath/DG Super 89 system

AlphaNet RCP/M RBBS. (913) 843-4259. Larry Miller; 6P-9A daily; (3;700K); B drive changes daily; (Lawrence)

Michigan

Schooner Cove (Ypsilanti) RCP/M. (313) 483-0070. Michael Wesley; (3;644K); B: changed daily, sysop will mount any disk on request. (Ann Arbor-Detroit area)

MINICBBS/Sorcerer's Apprentice Group. (313) 535-9186. Bob Hageman; (1-7;500K); Sorcerer software and hardware; (Detroit area)

Southfield, MI, RBBS/RCPM. (313) 559-5326. Howard Booker; (3;2.7M); BDS C programs, doc. files.

Tony's Corner RBBS. (313) 754-1131. Tony Bauman; (3B;???K); TRS-80 Model I system

Royal Oak CP/M. (313) 759-6569. Keith Petersen; (1-7;26M); MiniCBBS available but main purpose is file transfer; (Detroit area)

XEROX CORP RBBS. cb (313) 827-2266. Brad Harper; (3?;???K); If calling during working hours-call by voice first, after 5P call, hang up after recorder starts and call back immediately.

Technical CBBS. (313) 846-6127. Dave Hardy; (1-7;3M); RCPM sysops desiring access to passworded RCPM Clearing House system should leave msg on TCBBS; (Detroit)

OPTEC RBBS. (616) 897-8628. Jerry Persha; baud/disk unknown; Open system; interests in prof and amateur astronomy relating to photometry. (Lowell, MI)

Grand Traverse RCP/M. (616) 947-1246. Bill Jungers; (3B;10M); Kaypro, Franklin/Apple, Televideo; A member of the Kaypro Network; (Grand Traverse)

Minnesota

TCRCP/M Twin Cities RCP/M. (612) 333-5947. Larry Linde; (3B;5M); RBBS written in 'C'; (5 Mhz Big Board); (Minneapolis)

Missouri

St Louis HUG RBBS. (314) 291-1854. John Griffith; 1A-9A daily, 24 hrs on Sunday; baudrate and disk size

RCPM Directory

Continued from page 65

unknown; H-89 system

KAY-PER NET. (816) 734-2717. Ron Smith; (3B;10M). If no answer, voice call to SYSOP at (816) 4987 should correct the problem.

Ohio

Dayton RCPM/RBBS. (513) 256-7227. Dave Robling; (1-7;1M); (Dayton)

Cincinnatti RBBS. (513) 489-0149. Henry Deutsch; 6P-6A daily; (1-7;1.8M)

Columbus CBBS. (614) 272-2227. John Walpole; (1-7;300K); BDS-C programs

Pickerton RBBS. (614) 837-3269. Greg Bridgewater; (3;1M); Running TRS-80 with Omikron

Wisconsin

CHANL-3 RCP/M MYBBS. (414) 353-1667. Bill Ganley: (36B;5.5M); CB-80, Communications, S-100 system running USR S-100 modem; (Milwaukee)

Fort Fone File Folder. (414) 563-9932. Al Jewer, Shawn Everson, Ron Fowler; (1-7;20M); (Ft. Atkinson)

Milwaukee Heath Users Group RBBS (MHUG). (414) 873-7564. Mike Wesolowski; (3;15M); PRIVATE system maintained by Milwaukee Heath Users; running on Heathkit H89.

South

Alabama

NACS/UAH RBBS/RCPM. cb (205) 895-6749. Don Wilkes; (1-7;700K); (Huntsville)

Florida

Astronomer's RBBS & RCPM. (305) 268-8576. Chuck Cole; (no answer when in use); (3B;492K); Astronomy & science special interests: CFAS, AAVSO, ISRG, IAPPP, SERAL, and CANDL; (will have 2.4MB online soon); (Titusville)

SIMMS 002: Silicon Beach RCP/M. (305) 439-5754. Steve Sanacore; (3;256K); Apple CP/M; Multiple Message Bases; (West Palm Beach)

Melbourne RCP/M OXGATE. (305) 676-3573. Alex Soya; (3B;20M); new releases of CPMUG and SIG/M software; Information exchange re: hardware problems & fixes, especially S-100 machines; Interest in CPM86 & CPM68K software; (Melbourne)

Orlando, Florida RCPM System I. (305) 677-8086 $. Larry Snyder; (3BV;24M) Special interests in Compupro hardware, communications, spreadsheets, dBase II, C-86, CPM816 and MPM816. $30 annual membership, limited amount of users. Second system soon on-line supporting software compatable under MPM 8/16. Sysops, leave message on Detroit Sysop System for Complimentary membership.(Compupro 816 CP/M-80); (Suburb of Orlando)

Miami Bulletin and Exchange Board. (305) 854-7274. Jack Lamont, Kevin Killey, Calvin Thompson; (3B;6M); Kaypro 10 or at times a Kaypro II. Atari section, community involvement promoted.

CCPB-RCP/M Computer Club of the Palm Beaches. (305) 967-0344. Mark Fay; (system I: TU & TH 9P-12P; SU 12A-12P); (1-7;1.8M); Interest in libraries of recent and classic CP/M software. Jim Flora; (system II: M, W & F 9P-12P); (1-7;1.2M); Interest in ASCII printer graphics, CB80, and general CP/M software; (NOTE: Phone answered voice other hours.) (West Palm Beach)

Sanyo RCP/M. (813) ???????. Scott Holtzman; (3B;30M); Sanyo USA BBS/RCPM; System is down and will be coming back online with a new number; (Tampa)

Tampa RCP/M. (813) 831-7276. Charlie Hoffman; (3B;20M); New 20MB hard disk; Interest in 'C'; SIG/M-CPMUG releases; Tampa Bay CP/M User's Group

PRO-COM DATABASE. (813) 937-3608 $. (Formerly known as: The Tampa Bay Bandit Board RCP/M) Steve Sanders; (3B;10M); Private system; $25/yr fee; monthly newsletter; 2nd system soon; Headquarters of the Kaypro-Network; new users may log on to leave message for info/application; Latest SIG/M-CPMUG; Turn-Key K-NET 84™ RBBS-RCPM Systems available. (Tampa Bay)

This system is also a collection point for updates to this list. Please leave information as a comment before exiting system.

Georgia

Atlanta RCP/M-RBBS. (404) 627-7127. Jim Altman; (3B;4M); Soon to be 200 Mbyte; Interest in 'C', SIG/M, CPMUG releases; no answer when in use. (Atlanta)

Acropolis RBBS/RCPM. (912) 929-8728 $. Tony Stanley; (3B;10M); Support system for K-NET 84™ RCPM-RBBS software; Kaypro, Heath/Zenith, CPMUG and SIG/M software; New users must be verified before accessing the system; (Warner Robins, GA)

Kentucky

Ovation Network RCP/M. (606) 273-8634. Jay Denebeim; 6P-9A M-F, 24 hrs wknd; (3B;5M); Kaypro Lexington User's Group (KLUG); a KayPro-Network system; (Lexington) (NEW NUMBER as of 1/20/84.)

Louisiana

Bossier RCP/M. (318) 742-1772. Tom Chandler; (3;2.6M) Interest in CP/M, Utilities, Games, 16 bit. (Bossier City, LA)

Redstick RCPM. (504) 275-7846. Ken Shutt; (3;1.6M); CP/M+, Operating systems; (Baton Rouge)

Tennessee

Physician's Responsive Information System. (615) 967-6889. Dudley Fort; 5P-9A M-F; (3B;800K); Kaypro RBBS; major interest in medical software and information; on-line articles on topics excerpted from medical journals. (Mail address: Rt. 3, Box 289A, Winchester, TN 37398)

California

Northern California

OxGate-005 Fresno Micro Fone. (209) 787-3511. Bob

Continued on page 84

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CIRCLE 27 ON READER SERVICE CARD

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Model CPU-68000M High-performance CPU board with 16-bit data path, 10 MHz CPU operation, and MC68451 MMU for multi-tasking applications. $1195.

Model CPU-68000 Similar to 68000M, but features 8K bytes of on-board ROM with Motorola's MacsBug monitor instead of the Memory Management Unit. $895.

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Model AOM-12 This D-to-A converter offers I/O-mapped port address, 12-bit ±½ L.S.B. accuracy (0-70°C), and voltage outputs of 0 to 10 volts, ±5 volts, and ±10 volts. $675.

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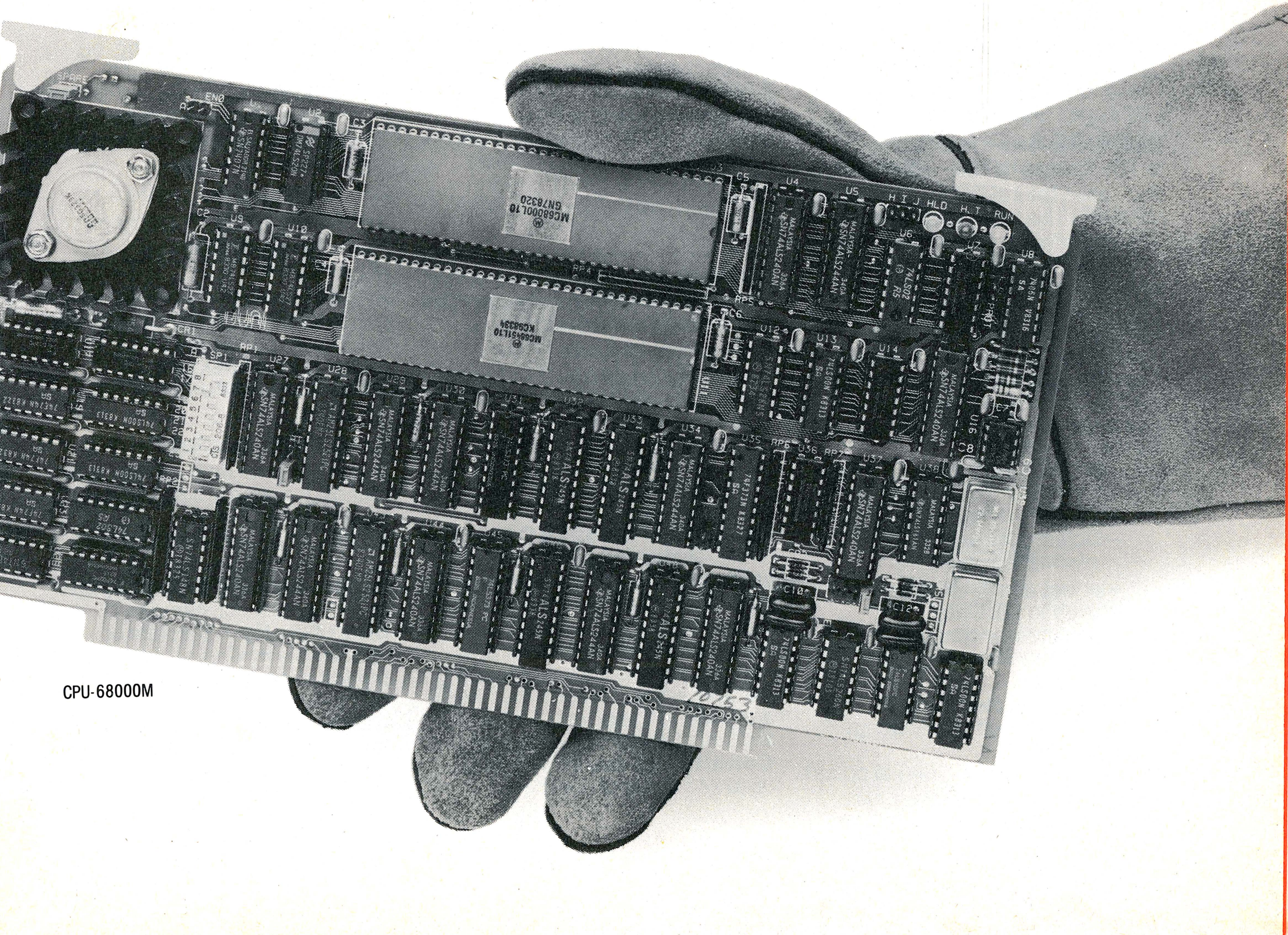

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- 52 pages User Manual

8086/88 Assembler with Translator $99.50

Available for MSDOS, PCDOS, or CPM/86! This fully relocatable macroassembler will asemble and link code for MSDOS (PCDOS) AND CPM/86 on either a CPM/86 or MSDOS machine. This package also includes:

- An 8080 to 8086 source code translator (no limit on program size to translate)
- A Z-80 to 8086 translator
- 64 page user manual
- 4 linkers included:
  - –MSDOS produces .EXE file
  - –CPM/86 produces .CMD file
  - –Pure object code generation
  - –Object code and address information only

Linker features:

- Links up to 128 files
- Submit mode invocation
- Code, Data Stack and extra segments
- Handles complex overlays
- Written in assembly language for fast assemblies.
- MICROSOFT .REL format option

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Z-8000 Cross Development Package $199.50

Instant Z-8000 Software! This package allows development and conversion of software for the Z8001, 8002, 8003 and 8004 based machines on a Z-80, Z-8000 or 8086 machine. This powerful package includes:

- a Z-80/8080 to Z-8000 Assembly Language Source Code Translator
- Z-8000 Macro Cross Assembler and Linker

The Translators provide Z-8000 source code from Intel 8080 or Zilog Z-80 source code. The Z-8000 source code used by these packages are the unique 2500AD syntax using Zilog mnemonics, designed to make the transition from Z-80 code writing to Z-8000 easy.

All 2500 AD Assemblers and Cross Assemblers support the following features:

Relocatable Code — the packages include a versatile Linker that will link up to 128 files together, or just be used for external reference resolution. Supports separate Code and Data space. The Linker allows Submit Mode or Command Invocation.

Large File Handling Capacity —the Assembler will process files as large as the disk storage device. All buffers including the symbol table buffer overflow to disk.

Powerful Macro Section— handles string comparisons during parameter substitutions. Recursion and nesting limited only by the amount of disk storage available.

Conditional Assembly—allows up to 248 levels of nesting.

Assembly Time Calculator— will perform calculations with up to 16 pending operands, using 16 or 32 Bit arithmetic (32 Bit only for 16 Bit products). The algebraic hierarchy may be changed through the use of parentheses.

Include files supported—

Listing Control—allows listing of sections on the program with convenient assembly error detection overrides, along with assembly run time commands that may be used to dynamically change the listing mode during assembly.

Hex File Converter, included —for those who have special requirements, and need to generate object code in this format.

Cross reference table generated—

Plain English Error Messages—

System requirements for all programs: Z-80 CP/M 2.2 System with 54k TPA and at least a 96 column printer is recommended. Or 8086/88 256k CP/M-86 or MSDOS (PCDOS).

Cross Assembler Special Features

Z-8—512 User defined registers names, standard Zilog *and* Z-80 style syntax support.

8748—standard Intel *and* Z-80 style syntax supported.

8051—512 User defined register or addressable bit names.

6800 Family—absolute or relocatable modes, all addressing modes supported, Motorola syntax compatible.

6502—Standard syntax or Z-80 type syntax supported, all addressing modes supported.

8086 and Z-8000 XASM includes Source Code Translators

	Z-80 CP/M®	ZILOG SYSTEM 8000 UNIX	IBM P.C. 8086/88 MSDOS	IBM P.C. 8086/88 CP/M 86	OLIVETTI M-20 PCOS
8086/88 ASM			$ 99.50	$ 99.50	
8086/88 XASM	$199.50	$750.00			$199.50
16000(all) XASM *new*	199.50	750.00	199.50	199.50	199.50
68000 XASM *new*	199.50	750.00	199.50	199.50	199.50
Z-8000™ ASM		750.00			299.50
Z-8000 XASM	199.50		199.50	199.50	
Z-80 ASM	49.50				
Z-80 XASM		500.00	99.50	99.50	99.50
Z-8 XASM	99.50	500.00	99.50	99.50	99.50
6301(CMOS) *new*	99.50	500.00	99.50	99.50	99.50
6500 XASM	99.50	500.00	99.50	99.50	99.50
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8085 XASM *new*	99.50	500.00	99.50	99.50	99.50
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F8/3870 XASM *new*	99.50	500.00	99.50	99.50	99.50
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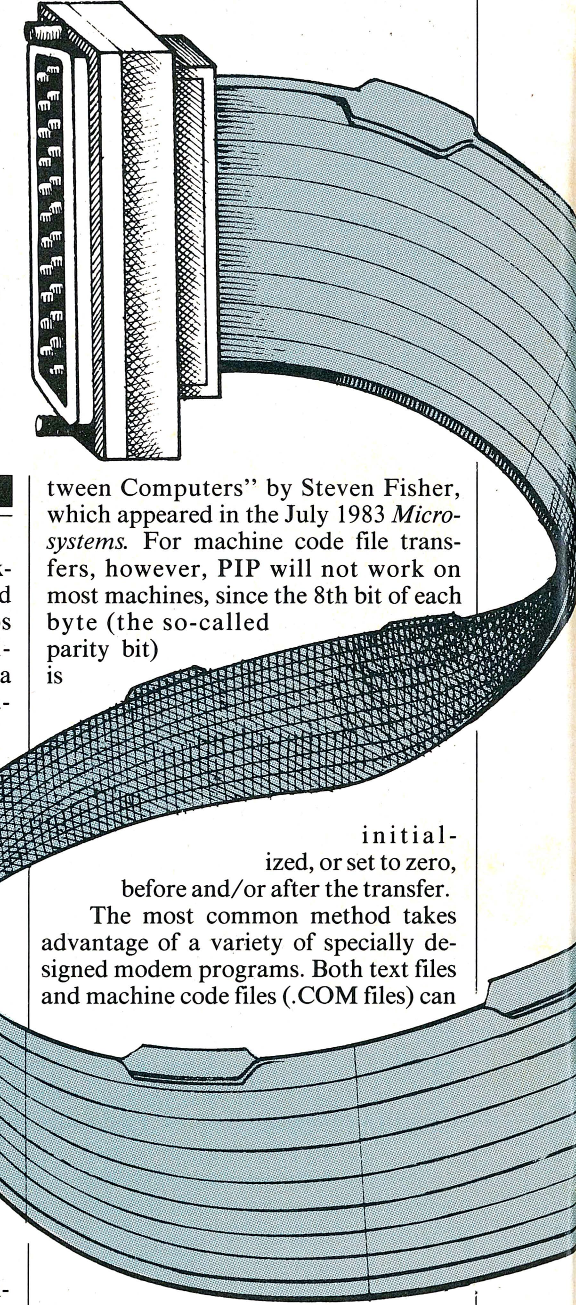
Computer-to-Computer File Transfer

Techniques for moving files between machines

by William C. Parke



In the 8″ disk world there exists a universal IBM standard format. CP/M user groups usually distribute their library in this format, and a plethora of intelligent machines can read them. Because of the universality of CP/M, a vast store of programs will also perform on a variety of 8080- and Z80-based computers. However, for those who use 5¼″ diskettes (''floppies'' to non-IBM people), there are more format species than can be easily justified. Thus there arises legitimate interest in transferring public domain, personal, and nonproprietary CP/M files from one computer to another with incompatible disk formats or sectoring.

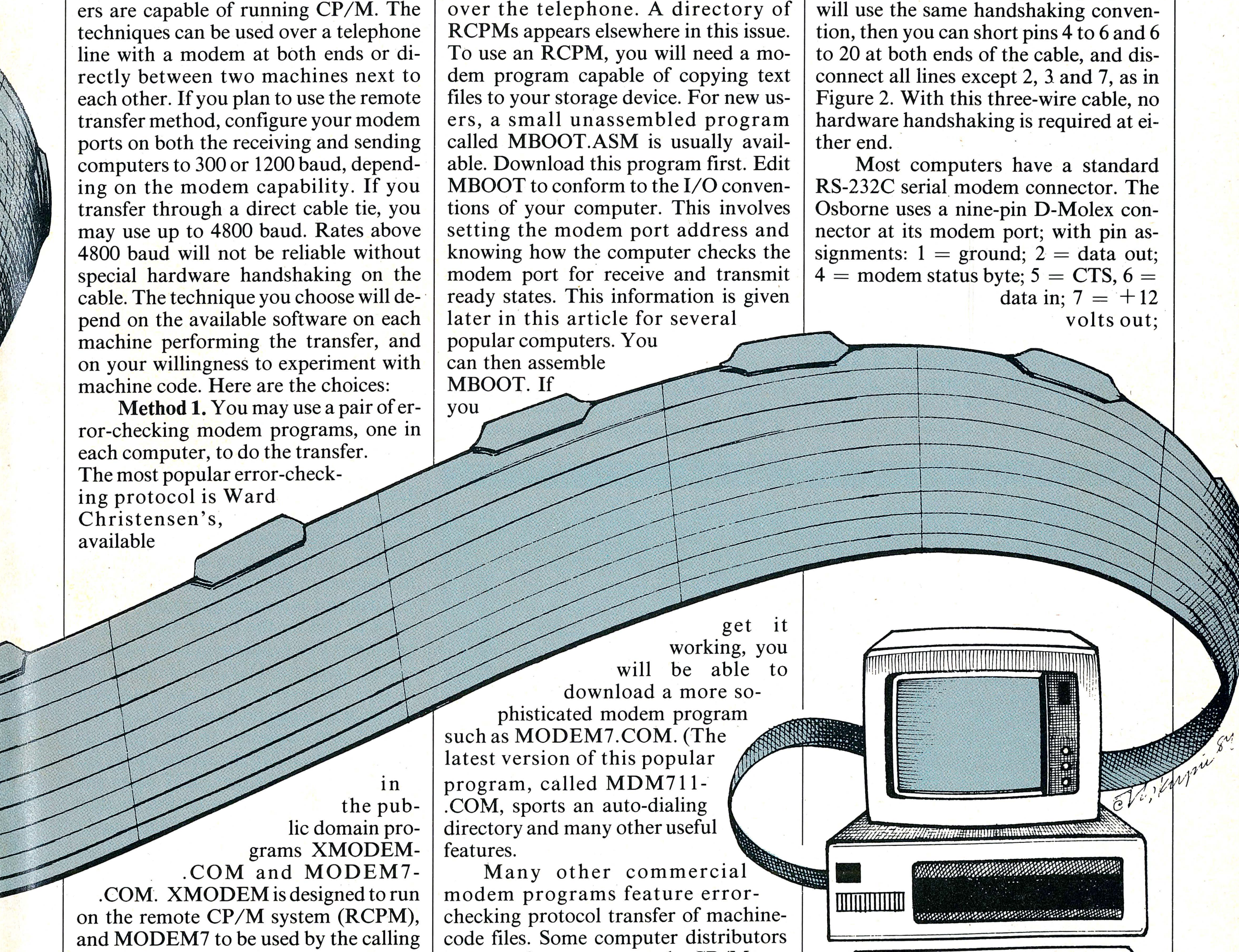
What options do we have? Possibly the simplest method would be to use the PIP utility (Peripheral Interchange Program) to send the files between properly configured computer ports. An example of this method is described in the article, ''PIP Data Between Computers'' by Steven Fisher, which appeared in the July 1983 *Microsystems.* For machine code file transfers, however, PIP will not work on most machines, since the 8th bit of each byte (the so-called parity bit) is initialized, or set to zero, before and/or after the transfer.

The most common method takes advantage of a variety of specially designed modem programs. Both text files and machine code files (.COM files) can be sent over telephone lines if the software is properly configured. Some telephone lines are subject to noise and are frequency bounded, so that file transfer is relatively slow (up to about 120 bytes/sec) and subject to degredation. At the typical rate of 300 baud (i.e., 300 bits/sec, or 30 characters per second), a 10K file would take about 6.5 minutes to transfer. At 1200 baud, the highest rate available over standard telephone lines, transfer of the same file would take about 1.4 minutes. Error checking during the transfer, such as that within the Ward Christensen protocol, significantly increases the transfer reliability. *(Editor's note: Noise is seldom a problem between major cities in the USA, regardless of distance, because trunk lines have good repeaters and are well balanced. The problem arises on country lines.)*

This article will concentrate on methods for the machine code file transfer that can be used when both computers are capable of running CP/M. The techniques can be used over a telephone line with a modem at both ends or directly between two machines next to each other. If you plan to use the remote transfer method, configure your modem ports on both the receiving and sending computers to 300 or 1200 baud, depending on the modem capability. If you transfer through a direct cable tie, you may use up to 4800 baud. Rates above 4800 baud will not be reliable without special hardware handshaking on the cable. The technique you choose will depend on the available software on each machine performing the transfer, and on your willingness to experiment with machine code. Here are the choices:

Method 1. You may use a pair of error-checking modem programs, one in each computer, to do the transfer. The most popular error-checking protocol is Ward Christensen's, available in the public domain programs XMODEM.COM and MODEM7.COM. XMODEM is designed to run on the remote CP/M system (RCPM), and MODEM7 to be used by the calling system.

For 5¼" disk users, there are more format species than can be easily justified.



You may obtain public domain modem programs for CP/M if you are able to read the 8" SSSD disks that CP/M user groups make available, or if you can sign on to a remote CP/M system over the telephone. A directory of RCPMs appears elsewhere in this issue. To use an RCPM, you will need a modem program capable of copying text files to your storage device. For new users, a small unassembled program called MBOOT.ASM is usually available. Download this program first. Edit MBOOT to conform to the I/O conventions of your computer. This involves setting the modem port address and knowing how the computer checks the modem port for receive and transmit ready states. This information is given later in this article for several popular computers. You can then assemble MBOOT. If you get it working, you will be able to download a more sophisticated modem program such as MODEM7.COM. (The latest version of this popular program, called MDM711.COM, sports an auto-dialing directory and many other useful features.

Many other commercial modem programs feature error-checking protocol transfer of machine-code files. Some computer distributors add transfer programs to the CP/M system software accompanying the computer. Whatever modem program you intend to use, you must have the programs up and running on both machines. Each machine will need a modem if you are transferring over the telephone, or a "null modem" cable to tie two modem ports together.

A null modem cable is a bundle of lines and connectors wired in a special way so that two DTE (Data Terminal Equipment) serial ports can be connected together. If the ports have RS-232C standard pins, the cable will have lines from pins 2 and 3 reversed, lines 4 and 5 reversed, and lines 6 and 20 reversed. Line 7 at one end is connected straight to 7 at the other. If a shielded cable is used, ground the shield to pin 1 at one end only. The wiring appears as shown in Figure 1.

Some modem programs allow you to set the RTS and DSR lines for handshaking. Most do not. If you have no assurance that both computer programs will use the same handshaking convention, then you can short pins 4 to 6 and 6 to 20 at both ends of the cable, and disconnect all lines except 2, 3 and 7, as in Figure 2. With this three-wire cable, no hardware handshaking is required at either end.

Most computers have a standard RS-232C serial modem connector. The Osborne uses a nine-pin D-Molex connector at its modem port; with pin assignments: 1 = ground; 2 = data out; 4 = modem status byte; 5 = CTS, 6 = data in; 7 = +12 volts out;

FILE TRANSFER

Continued from page 71

8 = modem control byte; 9 = RLSD. To construct a three-wire cable to a RS-232C DTE port, connect Osborne Molex pins 1, 2, and 6 to RS-232C pins 7, 3, and 2 respectively, and short 4 to 8 on the Molex plug.

Connect the modem ports together, then run the modem programs in each computer, using a baud rate up to 4800 in each program to send the desired .COM files across. If you attempt to send the files at a faster baud rate without assured handshaking, machines running their CPU at 2 MHz or slower will lose characters. (The Osborne 1 modem baud rate should be kept at 2400 or below.)

Method 2. CP/M will allow you to PIP text and hex files to a physical port, but will not permit .COM (machine code) files to transfer (the 8th bit of each byte is lost). To use unmodified CP/M to transfer .COM files, you must construct an Intel .HEX file first. This can be done with a .COM-to-.HEX file conversion program, such as UNLOAD.COM, or ASM.COM if the source code of the program you wish to transfer is available. You may transfer the files through the modem ports as in method 1, or through a standard RS-232C cable with male and female ends if you wish to use the receiving computer's serial printer port.

To use the receiver's printer port, configure the receiving computer RDR: to UR1, using the printer port address and a baud rate of 4800, if available. If you wish to use the receiving computer's modem port, substitute this address in configuring UR1. Then configure the sending computer PUN: to UP1, using the modem port address and a baud rate to match the sending rate. If you are requested to set word length, parity, and handshaking, choose 8 bits (2 stop bits), no parity, and no handshaking. Connect the two configured ports together with your cable. On the receiving computer, type

```
>PIP FILE.HEX=RDR:
```

and then on the sending computer,

```
>PIP PUN:=FILE.HEX
```

Use the DDT utility on the receiving system to change the .HEX file to a .COM file. If the file is large and you have not configured the handshaking of UR1 and UP1, you may lose the end of the file as PIP attempts to write its buffer to disk. Break the large .HEX file into smaller files and send these in segments. Reconstruct the file on the receiving computer by PIPing the segments to one file. Then use the DDT or LOAD utilities to generate a .COM file from the .HEX file.

To use an RCPM, load a modem program capable of copying text files to your storage device.

This technique may be awkward, particularly if the .COM file is large. Note that an Intel .HEX file is more than twice the size of the corresponding .COM file.

Method 3. It may also be possible to obtain a source listing of the CP/M BIOS code. The Heath Corporation supplies such a listing with their CP/M. You can then patch the physical I/O routine in CP/M to avoid the 8th bit parity mask for each byte. Look for ANI 7F acting on the bytes being transferred. Using DDT, substitute two NOPs to replace this instruction line. PIP could then be used to transfer .COM files directly, using method 2. Be sure to use the object code switch in PIP's command line so that the transfer will not stop on encountering a Control-Z in the file, nor let the 8th bit be lost inside PIP.

Method 4. Suppose you cannot patch CP/M, and the intended receiving computer has no modem program. If you have a modem program running on the sending computer that will send all 8 bits of each byte of code, you are halfway there.

First tie the modem port of the sending computer to a printer port of the receiving one with a standard male/female RS-232C cable. Configure the receiving computer's port to 4800 baud. Use the STAT command to get the record length of the file to be sent.

You will now need to give the receiving computer instructions on how to respond to the transmitting computer. Listing 1 is a small program you can enter to run on the receiving end. You can insert this program into memory directly, using the DDT "A" command, or type the assembly text file with your editor, which can be assembled and then loaded into memory. In the listing of the program, the first column shows the memory addresses that DDT gives you in its "A" mode to prompt for the next mnemonic. The second column gives the mnemonics you insert. The following columns display the assembler text you may use if you wish to assemble the code and keep it on disk.

To assemble the code, type the listing under the columns "Text:" and "Comments" below into a file named TRANS.ASM. Add the text for the port input routine labeled "PORT" that ap-

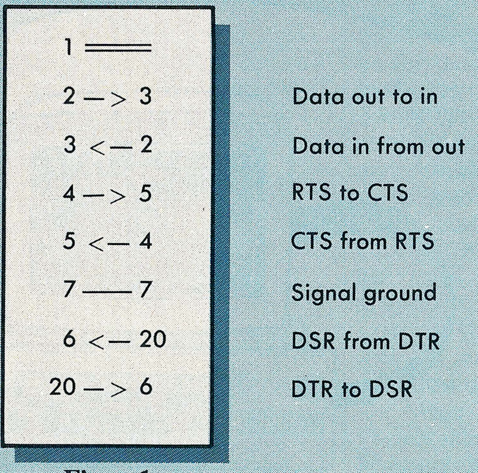


Figure 1

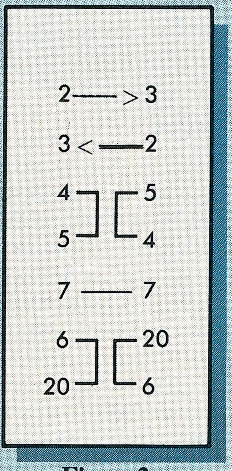


Figure 2

Table 1. I/O ports and status flags

Computer I/O chip Connection	Status port "sport"	Data port "dport"	Receive test bit "rbit"	Transmit test bit "tbit"
Heath/Zenith 89,90				
8250 ACE				
Modem	DD	D8	01	20
Printer	D5	D0	01	20
Heath/Zenith 100				
2661 USART				
Modem	ED	EC	02	01
Printer	E9	E8	02	01
Morrow Design				
8251 ACE				
Terminal	FD	FC	02	01
Printer/Modem	FF	FE	02	01
Superbrain				
8251 ACE				
Modem	59	58	02	01
North Star Horizon				
8251				
Terminal	03	02	02	01
Printer	05	04	02	01
Kaypro 4 and 10				
Z80 SIO				
Modem	06	04	01	04
Printer (serial)	0E	0C	01	04

plies to the receiving computer, then the "END" instruction as the last line. With the CP/M program ASM on the disk, type

```
>ASM TRANS.AAZ
```

If the program assembles with no errors, load the TRANS.HEX file with the command

```
DDT TRANS.HEX
```

Check the program in memory by listing (the "L" command) the addresses shown below.

If you intend to enter the program directly on the receiving computer, type DDT on the receiving computer. Enter the "bare bones" program in Listing 1 with the "A" command, inserting the mnemonics and following hex code under the column "Entry:". I assume a 64K machine; if you have 48K, change C0 to 80 in the addresses below. With starting address C000, you can transfer a file up to 48K in length. Pick the port input routine appropriate to the receiving computer and add it to code in memory. You may check the program by listing it with -LC000.

The subroutine called at C006 requires a direct port read to avoid having CP/M slash the 8th bit of incoming bytes. This makes the code machine-dependent. The routine gets received bytes from the UR1: port.

For a variety of computers, including Heath, Zenith, Morrow, North Star, Kaypro, and Superbrain, the modem character-input routine has the same form as shown in Listing 1a.

Before assembly, the hex values for "sport", "tbit", and "dport" must be inserted. Table 1 gives the values to use for some of the popular computers for which the above code applies.

For the Apple II running CP/M on a Z80 card with a Serial Communication Interface card or the CCS7710A Serial Interface in Slot II, use the Listing shown in 1b to receive from the modem port.

For the Osborne 1, input/output is done in the second bank of memory and is limited to 300 or 1200 baud (unless you change a jumper internally). Use the receive routine in Listing 1c.

After entering and checking the program, type -GC000 to start the program. This will set the receiving computer in a waiting state. Now send the file from the sending computer by using its modem program, which sends all 8 bits of each byte with no handshaking. When the sending computer is finished, type a Control-C on the receiving computer, then >SAVE nn FILE.COM, where nn is the number of 256-byte pages in the file (i.e., the number of records rounded up to the next even number, then divided by 2).

Method 6. If you do not have a modem program on the sending computer, you may need to construct one with DDT or the CP/M assembler. The minimal program would do the following: open the desired file, whose name has been inserted into the default file control block with the DDT "I" command; read a 128-byte record into memory; send it to the modem port; and repeat until an EOF flag is reached. On the receiving end, use the program in method 5. Listing 2 gives a suitable program inserted with the DDT "A" command or assembled and then loaded with DDT. Again, the "port out" routine called at 8021 is machine dependent. If you have one of the machines listed in Table 1, use this table to identify "sport", "tbit" and "dport". Insert these into the code in Listing 2a and type it in. Other modem output routines are given in Listings 2b and 2c.

If your computer has a different configuration, you will need to rewrite the port IN-OUT part of the code. Before beginning this program, determine the record length of the file to be transferred with the STAT command so that the proper number of pages can be saved.

After the appropriate lines are loaded with DDT, begin the receiving computer's program with -GC000, enter the filename on the sending computer with the "I" command in DDT, then begin the transmitting program with -G8000. When the sending computer reboots, use Control-C and then SAVE nn FILE.COM on the receiving computer, where nn is the number of file pages, as before.

Both this sending program and the receiving program above are likely to stay in memory until the computers are turned off, even if the systems are reset. If you plan to use them again, check with the DDT "L" command that they are there before a GO instruction.

Once you have a good modem program working on both systems, you need not use these more primitive methods. You will be able to send and receive .COM files and any other files with error checking and other helpful features.

William C. Parke, Associate Professor of Physics, the George Washington University, Washington, D.C. 20052

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Continued from page 73

Listing 1. File receive program

```
DDT  Entry:       | ASM  Text:            Comments:
------------------|-------------------------------------------
                  |      ORG 0C000H       ; Start in high mem.
C000 LXI H,100    |      LXI H,0100H      ; Set up load address
C003 LXI SP,C0FF  |      LXI SP,0C0FFH    ; Set Stack
C006 CALL C031    | LOOP CALL PORT        ; Get byte from port
C009 MOV M,A      |      MOV M,A          ; Put in memory
C00A INX H        |      INX H            ;
C00B PUSH H       |      PUSH H           ;
C00C ANI 7F       |      ANI 07FH         ; Set up echo char
C00E CPI 20       |      CPI 20H          ;
C010 JNC C015     |      JNC SHOW         ; Show Ascii chars
C013 MVI A,2E     |      MVI A,´.´        ; ´Dot´ out CTLs
C015 MOV E,A      | SHOW MOV E,A          ;
C016 MVI C,02     |      MVI C,2          ;
C018 CALL 05      |      CALL 5           ; Echo to console
C01B POP H        |      POP H            ;
C01C JMP C006     |      JMP LOOP         ; Go for more
C01F MVI C,06     | CONS MVI C,6          ; Console in?
C021 MVI E,FF     |      MVI E,0FFH       ;
C023 PUSH H       |      PUSH H           ;
C024 CALL 05      |      CALL 5           ;
C027 POP H        |      POP H            ;
C028 CPI 03       |      CPI 3            ;
C02A JNZ C031     |      JNZ PORT         ; If not CTL-C, go back
C02D POP D        |      POP D            ;
C02E JMP 0        |      JMP 0            ; Reboot, (then SAVE)

    (insert PORT subroutine here)

                  |      END              ;
```

Listing 1a. Common modem input routine

```
C031 IN sport     | PORT IN sportH        ; Get status of port
C033 ANI rbit     |      ANI rbitH        ; Test rec ready bit
C034 JNC C01F     |      JZ CONS          ; If not, check cons
C037 IN dport     |      IN dportH        ; Get data from port
C039 RET          |      RET              ; Return with byte
```

Listing 1b. Special modem input routine for Apple computers

```
C031 LDA E0AE     | PORT LDA 0E0AEH       ; Get status byte
C034 RAR          |      RAR              ; Check if ready
C035 JNC C01F     |      JNC CONS         ; If not, ck cons
C038 LDA E0AF     |      LDA 0E0AFH       ; Get memory byte
C03B RET          |      RET              ;
```

Listing 1c. Special modem input routine for Osborne computers

```
C031 DI           | PORT DI               ;
C032 XRA A        |      XRA A            ;
C033 OUT 0        |      OUT 0            ; Switch to Bank 2
C035 STA EF08     |      STA 0EF08H       ; Set Bank Flag
C038 EI           |      EI               ;
C039 NOP          |      NOP              ;
C03A LDA 2A00     |      LDA 02A00H       ; Get Port Status
C03D RAR          |      RAR              ;
C03E JNZ C01F     |      JNZ CONS         ; Try Console
C041 LDA 2A01     |      LDA 02A01H       ; Get Port Data
C044 DI           |      DI               ;
C045 PUSH PSW     |      PUSH PSW         ;
C046 MVI A,1      |      MVI A,1          ;
```

```
C048 OUT 01         |       OUT 1            ; Back to Bank 1
C04A STA EF08       |       STA 0EF08H       ; Set Bank Flag
C04D POP PSW        |       POP PSW          ;
C04E EI             |       EI               ;
C04F RET            |       RET              ;
```

Listing 2. File transmit program

```
DDT  Entry:         | ASM  Text:            Comments:
------------------- |------------------------------------------
                    |       ORG 8000H        ; Start in high mem.
8000 LXI SP,80FF    |       LXI SP,080FFH    ; Set stack pointer
8003 LXI D,5C       |       LXI D,5CH        ; Open file named
8006 MVI C,0F       |       MVI C,0FH        ;
8008 CALL 5         |       CALL 5           ;
800B CPI FF         |       CPI 0FFH         ;
800D JZ 0           |       JZ  0            ; Exit if error
8010 LXI D,5C       | NEXT  LXI D,5CH        ; Read a record
8013 MVI C,14       |       MVI C,14H        ;
8015 CALL 5         |       CALL 5           ;
8018 ANA A          |       ANA A            ;
8019 JNZ 0          |       JNZ 0            ; Exit if EOF
801C LXI H,80       |       LXI H,80H        ; Transfer from memory
801F MVI B,80       |       MVI B,80H        ;     128 bytes
8021 CALL 802C      | LOOP  CALL OUTP        ; Send a byte to port
8024 INX H          |       INX H            ;
8025 DCR B          |       DCR B            ;
8026 JNZ 8021       |       JNZ LOOP         ; More to send
8029 JMP 8010       |       JMP NEXT         ; Try for next record

   (insert OUTP routine here)

                    |       END              ;
```

Listing 2a. Common modem output routine

```
802C IN  sport      | OUTP  IN sportH        ;   Check if port
802E ANI tbit       |       ANI tbitH        ;     is busy
8030 JZ 802C        |       JZ OUTP
8033 MOV A,M        |       MOV A,M          ;
8034 OUT dport      |       OUT dportH       ;   Send to Port
8036 RET            |       RET              ;
```

Listing 2b. Apple II (with Z80) modem output routine

```
802C LDA E0AE       | OUTP  LDA 0E0AEH       ; Get status byte
802F ANI 02         |       ANI 2            ;
8031 JZ 802C        |       JZ OUTP          ; Not ready
8034 MOV A,M        |       MOV A,M          ;
8035 STA E0AF       |       STA 0E0AFH       ; Put byte in port
8038 RET            |       RET              ;
```

Listing 2c. Osborne 1 modem output routine

```
802C DI             | OUTP  DI               ;
802D XRA A          |       XRA A            ;
802E OUT 0          |       OUT 0            ; Switch to Bank 2
8030 STA EF08       |       STA 0EF08H       ; Set Bank Flag
8033 EI             |       EI               ;
8034 NOP            |       NOP              ;
8035 LDA 2A00       | OUTT  LDA 2A00H        ; Port Status Byte
8038 ANI 02         |       ANI 2            ;
804A JZ 8035        |       JZ OUTT          ; Not ready
804D MOV A,M        |       MOV A,M          ;
804E STA 2A01       |       STA 2A01H        ; Put byte in port
8051 DI             |       DI               ;
8052 MVI A,1        |       MVI A,1          ;
8054 OUT 01         |       OUT 1            ; Back to Bank 1
8056 STA EF08       |       STA 0EF08H       ; Set Bank Flag
8059 EI             |       EI               ;
805A RET            |       RET              ;
```

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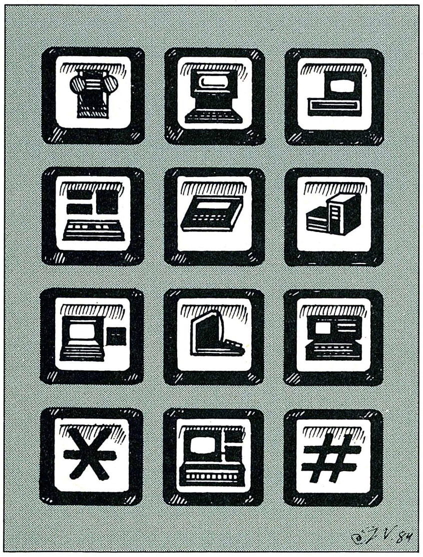
Versatile Communications with ASCOM

A communications package for all reasons



by Eric R. Haberfellner & G. David A. Weston

Anyone who acquires a microcomputer spends the first few weeks of life in his new environment enjoying the thrill of "all nighters"—chasing bugs in program code that he has written himself. But after his first flush of excitement has dissipated (along with his general health, his family harmony and the household supply of coffee!), he can usually be enticed into admitting that at some time he has muttered to himself, "there must be a better way."

One of the "better ways" that has developed for computer users is the ability to transfer programs and data from one machine to another so that every programmer does not have to reinvent the wheel or manually re-enter program listings and text. The most common means of doing this is by indirect transfer on magnetic disk—if the disk formats of the two machines are compatible and if the interested parties live close enough to make the media exchange convenient. Barring these conditions it is necessary (and in any case preferable) to pass the files directly from one machine to the other. The ability to do this across a telephone link greatly facilitates the process. But it cannot be done unless each of the machines is equipped with compatible communications software to manage the data transfer.

As program developers, we must frequently swap program patches and test versions of software. The inconvenience of living 10 miles apart, plus the 8″ versus 5 ¼″ disk incompatibility of our systems and a shared revulsion to 3 a.m. coffee made us acquire a communications program that would ease the pain of data transfer.

There are many situations where direct data transfer is desirable but, unfortunately, no single transmission protocol is capable of handling them all. A communications program that is flexible enough to receive or send data between several operating systems with different hardware and transmission protocols over a telephone line is a valuable asset indeed. We have tested such a package under the following conditions and have been delighted with its versatility and ease of use:

- Micros to system without flow control
- Downloading programs from CP/M-80 to a diskless 6809 single-board system
- MS-DOS (PC-DOS) to CP/M file transfer
- Billboard software exchange
- Accessing information services (e.g., THE SOURCE)
- Portable software exchange
- Data transfer between systems with incompatible disk formats (8″ disks, 5 ¼″ disks, microfloppies, etc.)

ASCOM (ASynchronous COMmunication control program), available from Dynamic Microprocessor Associates, is the serial communications program that we used for file transfer in all the above situations. ASCOM is available for operation under CP/M-80, CP/M-86, MS-DOS, PC-DOS, SB-80, SB-86, and other compatible operating systems.

When the ASCOM program is initiated, it comes up in a menu-driven mode that is very easy for the beginner to use. The screens are clear and the options are well explained. Direct command mode can be entered through a menu option, or the menu can be circumvented entirely by typing a space immediately after the ASCOM command when the program is invoked. This is very useful. We have found that beginners become experienced users fairly quickly; once one has reached that point, the direct command mode facilitates use without sacrificing ASCOM's valuable HELP features.

ASCOM also has one of the best on-line help facilities we have ever seen in a communications package. The HELP command will list all of the available commands, and

```
HELP [command name]
```

will give a detailed description and syntax of the command. This on-line help feature is sufficient to get a user started without consulting the manuals if he has some prior experience with serial communications. Most of the commands are prompting; if one is entered without arguments the options are listed, the current setting is displayed and an opportunity is given to alter it.

ASCOM has a very nice batch mode that permits execution of files consisting of ASCOM commands. This allows you to keep an ASCOM batch file for each of the systems that you regularly contact, in which baud rate, block size, parity, etc. are preset. Using the intelligent modem support, you can even have ASCOM dial the phone and make the connection for you. A batch file can be invoked when ASCOM is started up by entering the filename as an argument to the ASCOM command. For instance, "ASCOM SOURCE" might connect you to the SOURCE.

Batch files can also be invoked from inside ASCOM with the BATCH command. For example, we might create a batch file called "SNDFILES" containing the following commands:

```
PROTOCOL BLOCK
BLSIZE   512
PARITY   ODD
SEND     PROG1.ASM
SEND     PROG2.FOR
SEND     RUNIT.COM
ENDBATCH
```

The three files (PROG1.ASM, PROG2.FOR and RUNIT.COM) could be transferred by entering the single command:

```
BATCH SNDFILES
```

Furthermore, the IFERR or IFNDERR commands can be used to check whether a batch command has executed sucessfully. An example given in the reference manual illustrates how to use this facility to autodial a number every 5 minutes until an answer is received. The following commands in a file called "CONNECT" can be used to accomplish this:

You can write a batch file that dials another system, logs on, transmits and receives files, then logs off.

```
BAUD 300
DIAL 6877115
IFERR WAIT 300
IFERR BATCH CONNECT
```

This sequence of commands works because batch files cannot be nested. The BATCH CONNECT command simply restarts the batch file from the beginning.

There is also a command to transmit ASCII strings over the serial port from batch mode (SEND "Anything you want"). This means that a batch file can supply your user ID and password or any other commands to a host system.

It is possible to write a batch file that will dial another computer until it gets an answer, logs on, transmits some files, receives some files and then logs off—all while you are eating your dinner.

In its simplest mode of operation ASCOM can act as a dumb terminal to access almost any computer that can act as a host system over an asynchronous serial link. This mode is activated by ASCOM's CONV command (conversational mode). The program supports all the options you are likely to need to configure your serial port for communications with other computers. However, there is no command for setting the number of data bits, or the number of stop bits. We have not found that the lack of these capabilities has ever actually stopped us from making a connection, but if they should ever become absolutely necessary, these capabilities could be added through the ASCOM USER commands. (More about this later.) Once ASCOM has been configured the way that you want it to be, you can use the SAVE command to update the ASCOM.COM file. The next time ASCOM is invoked, it will come up configured as it was the last time the SAVE command was issued. The standard port configuration commands are shown in Table 1.

It is possible to have the terminal session logged to a printer by using the CONV/P command to enter conversational mode, or by toggling the printer on and off once a conversation has been started (F5 on IBM PCs, Control-P in CP/M). One of the authors has a CP/M system with a printer that is not interrupt driven, and the earlier versions of the ASCOM printer logging feature always used to cause some incoming characters to be missed. With the new LPSTATUS command (ASCOM version 2.27 and later) this is no longer the case. The LPSTATUS feature uses 4K of RAM as a printer buffer, and can be turned off if it is not needed, or if the line printer status feature is not implemented in the BIOS.

Frequently, when accessing large computers or information services, such as The SOURCE, it is desirable to capture some of the data for later processing. In order to do this, it is necessary not only to be able to view the information (as is possible with a dumb terminal) but also to log it to a disk file. ASCOM provides this capability with its CAPTURE command.

When using ASCOM's CAPTURE command, it is not necessary for the host system to support any particular protocol. The data is stored in the precise form in which it was transmitted by the host. Upon examination, the captured file will prove to be an exact duplicate of the information displayed on the screen during the CAPTURE-enabled terminal session. The ASCOM capture mode allows you to specify whether to log transmitted, received, or both transmitted and received characters to the capture disk file. The commands necessary to use the capture mode are shown in Table 2.

In addition, the commands shown in Table 3 are available in conversational mode. This brings up a minor complaint about ASCOM, as well as another one of its features. Certain control characters are necessary for the proper operation of many host computers. If ASCOM interprets them as commands,

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they do not get passed to the host. For example, Control-D is a very important character on most UNIX systems. The keys used to activate the conversational mode command are not definable by the user. They should be. On the other hand, ASCOM has a translation capability that can be used to solve the problem.

This is less of an annoyance in the IBM PC version of ASCOM, which uses the function keys for the conversation mode subcommands. In the CP/M version, two methods are available to send such characters to the host: 1) Enter ESC followed immediately by Control-D (or other desired control character); 2) Use the ASCOM translation-table capability.

The true workhorses of ASCOM file transmission, however, are the SEND and RECEIVE commands used for sending and receiving files from ASCOM's command mode. What type of transfer they will perform is determined by several other commands issued before the SEND or RECEIVE command. We refer to this type of transfer as a protocol transfer, because both machines must be able to participate in at least a minimal protocol exchange in order for the transfer to take place properly. This protocol can be extremely simple, as we will see, but some type of feedback from the receiving system must be present. The ASCOM commands used to control protocol transfers are shown in Table 4.

Table 1. Port configuration commands

AUTOLF	Automatic linefeed after carriage return
BAUD	Baud rate selection
ECHO	Local or host character echo selection
INIT	Initialize port with selected baud rate
PARITY	Parity selection

Table 2. Capture mode commands

OPEN ufn	Open the unambiguous filename as the capture file
CAPTURE option	Select which type of characters you wish to capture (IN, OUT or BOTH)
CAPTURE ON or OFF	Enable or disable capture mode from command mode
CLEAR	Clear the capture buffer
CLOSE	Flush the capture buffer to disk and close the capture file
DISPLAY	Display the contents of the capture buffer
DUMP	Write the capture buffer to disk. This clears it so that more data can be captured.
AUTODUMP ON or OFF	Dump the capture buffer automatically whenever it gets full

Table 3. Conversational mode commands

IBM-PC	CP/M	
F1	CTRL-B	break
F3	CTRL-D	capture on
F4	CTRL-E	capture off
F5	CTRL-P	print
F10	CTRL-A	exit conversational mode

Table 4. Protocol transfer commands

BLSIZE n	Selects the transmission data block size for the protocols
DELAY n	Sets line turnaround time delay time to n seconds for CRLF protocol
ENDCHAR xx	Sets the end of file character to xx hexadecimal
GSEND	Group send. Multiple-file send that does not cause the receiver to exit to command mode when finished. This allows the chaining of multiple-file sends.
PROTOCOL prot	Select the transmission protocol for the transfer
RECEIVE file/disk	Receive a file or files from another computer
RESUME	Restart the last multiple-file operation from the beginning of the last file that was not completely sent.
RETRY	Set the maximum retry count for the block transmission protocols
SEND ufn or afn	Send a file or files to another computer
TIMEOUT n	Specify the number of seconds to wait before assuming that the other computer is not going to talk to you

The capture mode is fine for just receiving ASCII information from large systems when you are signed on as a terminal, but sometimes you will want to send information to a host system that does not support any special file transfer protocol. You can do this with ASCOM by using either flow control or line-by-line transmission.

Most full-duplex host computers support a very simple flow control protocol often referred to as XON/XOFF. In this protocol, if the receiving system determines that it cannot keep up with the transmission rate, it sends an XOFF character to the sending system, which then stops transmitting data until it receives an XON.

This simple scheme allows two computers with different throughput bandwidths to communicate without losing any data if one of them is unable to keep up. The PROTOCOL OFF setting in ASCOM selects this method of communication. ASCOM can also receive files in this mode.

If you want to send a file to a host computer that echoes the characters transmitted back to you and does not support XON/OFF protocol, you can use the CRLF protocol. This transmission mode requires ASCOM to send one line at a time and then wait until the other computer echoes a linefeed character. When this happens, ASCOM knows that the host system has finished processing the line. ASCOM now waits for the number of seconds specified by the DELAY parameter and then sends the next line.

All that the host requires to receive files sent with the CRLF protocol is a program that takes input from the terminal and writes it to a file. Most text editors in INSERT mode are adequate for this purpose. Simply prepare the host to receive the file, and issue the ASCOM SEND command.

The methods of data exchange discussed so far are limited in usability if high reliability is required or data has to be transfered as an 8-bit binary image, such as ".COM" or ".EXE" files. If you happen to get a burst of line noise while in CAPTURE mode, you will have garbage characters embedded in your capture file. You don't have to use modems for very long before you find out how noisy some telephone lines can be. In order to transfer this type of file without having to worry about line noise or missed data, an error-checking block protocol must be used. In order to use a block protocol to transfer information,

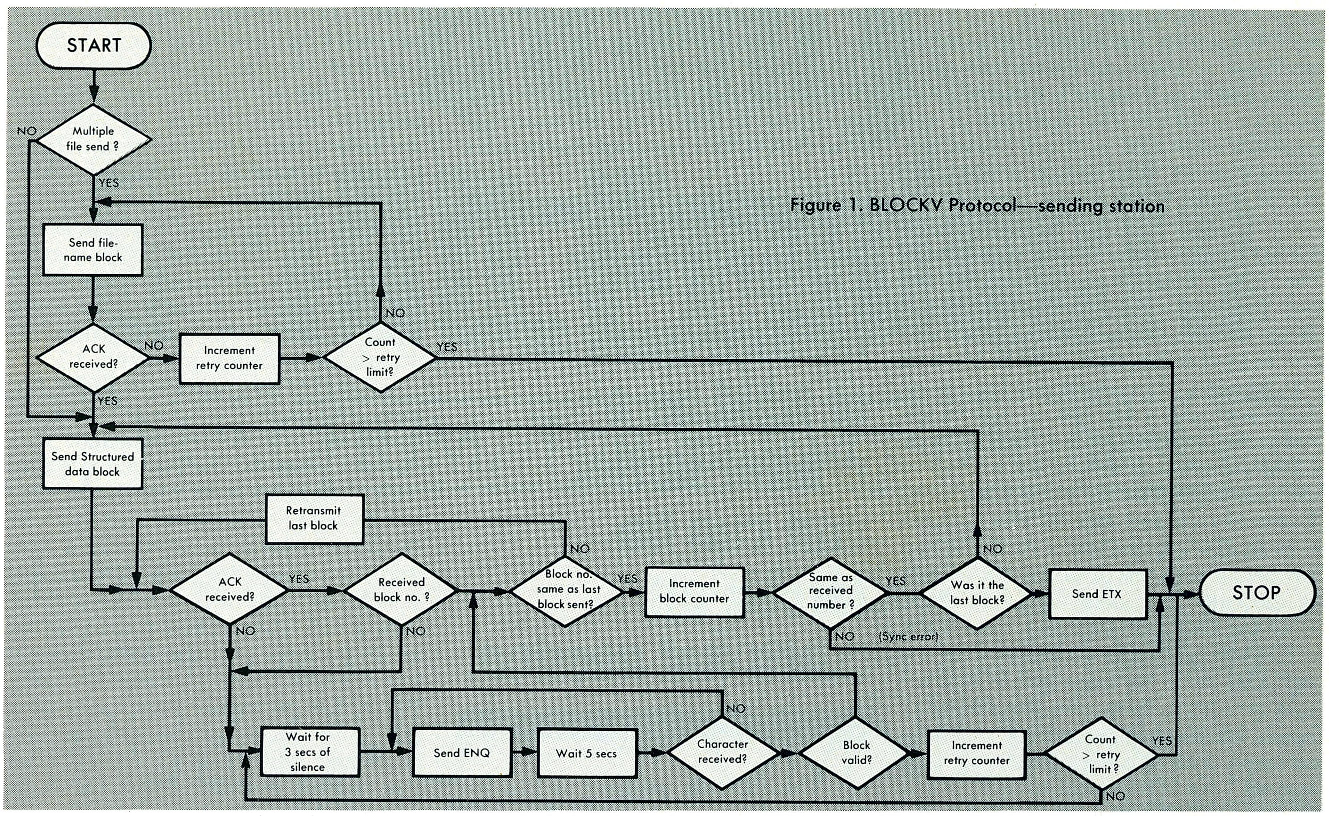
Figure 1. BLOCKV Protocol—sending station

START
Multiple file send ?
NO
YES
Send file-name block
ACK received?
NO
Increment retry counter
Count > retry limit?
NO
YES
YES
Send Structured data block
Retransmit last block
NO
ACK received?
YES
Received block no. ?
Block no. same as last block sent?
YES
Increment block counter
Same as received number ?
YES
Was it the last block?
NO
Send ETX
STOP
NO
NO
NO
(Sync error)
Wait for 3 secs of silence
Send ENQ
Wait 5 secs
Character received?
NO
Block valid?
Increment retry counter
Count > retry limit ?
YES
NO

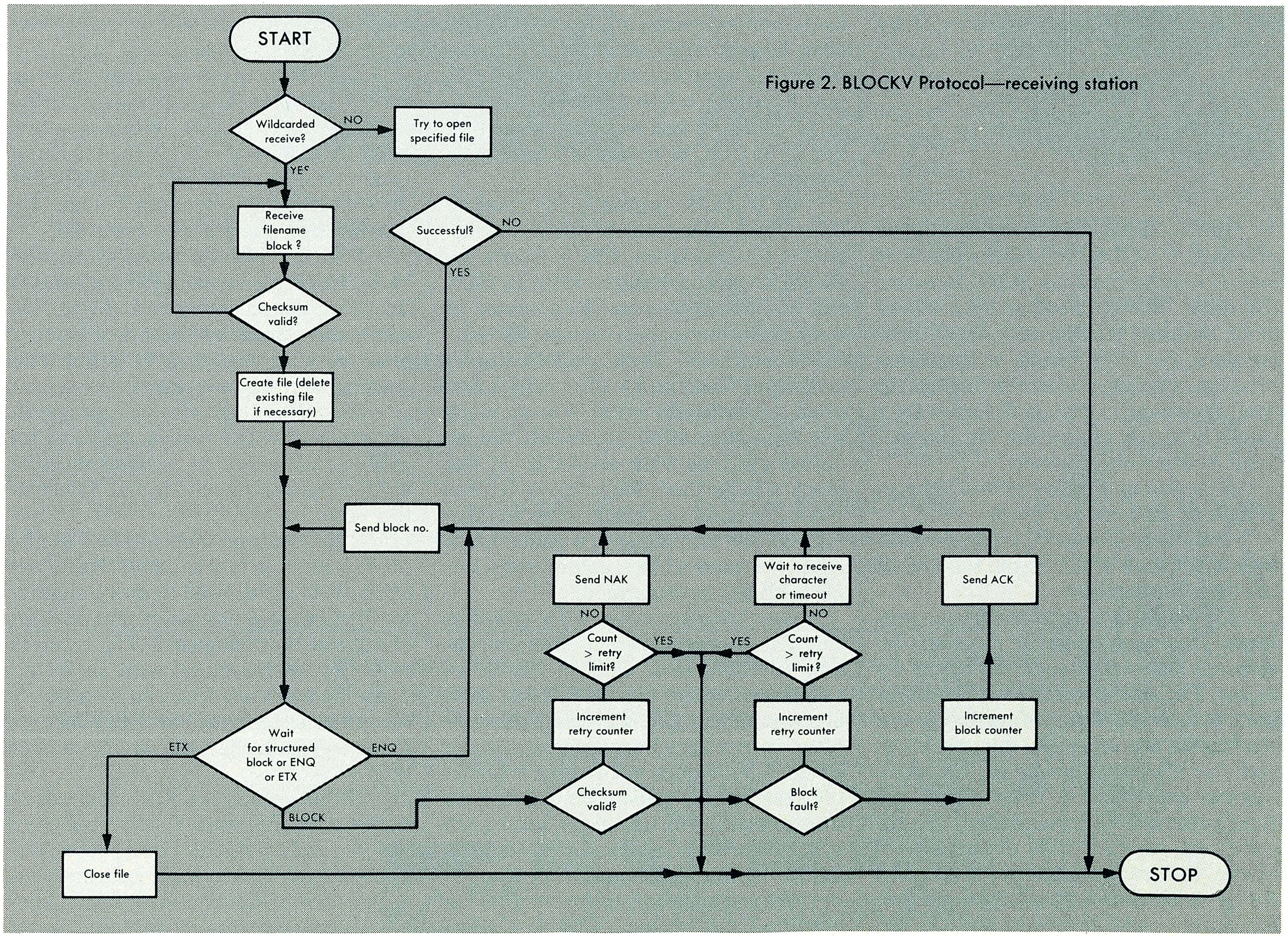
Figure 2. BLOCKV Protocol—receiving station

START
Wildcarded receive?
NO
Try to open specified file
YES
Receive filename block ?
Checksum valid?
Successful?
NO
YES
Create file (delete existing file if necessary)
Send block no.
Send NAK
Wait to receive character or timeout
Send ACK
NO
NO
Count > retry limit?
YES
YES
Count > retry limit?
Increment retry counter
Increment retry counter
Increment block counter
Wait for structured block or ENQ or ETX
ETX
ENQ
BLOCK
Checksum valid?
Block fault?
Close file
STOP

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both the sender and receiver must agree upon the protocol and parameters to be used, and of course both systems must be able to satisfy the demands of the protocol. ASCOM supports three different block protocols: CPMUG, BLOCK and BLOCKV.

The protocol that ASCOM calls CPMUG is more commonly known as the XMODEM, or Christensen, protocol. This protocol is supported by many other serial communications programs for both the MS-DOS (PC-DOS) and CP/M operating systems and has gained wide acceptance for use in microcomputer file exchanges. ASCOM calls it CPMUG because this is the method of file exchange used by both the CP/M Users Group and the RCPM bulletin boards. Earlier versions of ASCOM had a problem with this protocol, but no hint of difficulty is evident in version 2.28. Both the IBM PC version (2.27) and the CP/M version (2.28) come with an ASCOM batch file to set up ASCOM for this protocol; however, the IBM PC batch file was not executable, owing to an improperly specified (but easily corrected) PARITY command.

In order to use CPMUG, the following ASCOM parameters must be set:

```
PROTOCOL  CPMUG
TIMEOUT   60
ECHO      OFF
PARITY    SPACE
BLSIZE    128
```

In the CPMUG protocol, a block is preceded by a 3-byte header. The first byte of this header is an SOH character (01 hex). This is followed by a 1-byte block number, starting with 01. If there are more than 256 blocks in the transmission, the block numbering starts over again at 01. This is followed by a single byte containing the 1's complement of the block number.

The header is followed by 128 bytes of data (8 data bits per byte).

This body of data is followed by a 1-byte checksum, which is the total of all the data bytes only.

CPMUG is a receiver-driven protocol. This means that the transmission does not start until requested by the receiver. The sender waits for a NAK (15 hex) before sending its first block. As the blocks are received, the checksum and the 1's complement of the block number are checked. If the block has been successfully transmitted, the receiver will issue an ACK (06 hex). Otherwise, the receiver returns a NAK and the block is retransmitted. After the last block, the sender transmits an EOT (05 hex) indicating that no more data remains to be sent.

We have used CPMUG protocol to communicate with at least one other IBM PC communications package (PCTALK) and the local CP/M bulletin boards. In both cases, the latest versions of ASCOM performed admirably.

The LPSTATUS feature uses 4K of RAM as a printer buffer and can be turned off when not needed.

The BLOCK protocol is the first block transmission protocol supported in the early versions of ASCOM. It has been largely superseded by the newer BLOCKV protocol. However, BLOCK may have been left in the newer versions of ASCOM for use with programs that speak BLOCK protocol on other computers.

In BLOCK protocol, the receiver must be ready before the sender can begin transmission. Each block in BLOCK protocol starts with an STX (02 hex), followed by the number of data characters specified by the BLSIZE command. These are followed by an ETB (17 hex) and a 2-byte checksum of all the 8 bit data bytes. When a block has been successfully received, the receiver returns with an ACK. If the block was garbled, the receiver returns NAK, causing the block to be retransmitted. The transmission is ended when ASCOM sends a block containing a single ETX (03 hex) character.

Our favorite protocol for transferring data between two computers running ASCOM is BLOCKV. This is an enhancement of BLOCK that uses block numbers and will resynchronize after interrupted transmissions. In BLOCKV, it does not matter whether the receiver or transmitter starts first: transmission will not begin until each system is satisfied that the other is ready.

On one occasion, when we were using BLOCKV protocol with two flakey acoustically coupled modems, the carrier dropped (nothing unique about that!). In a programmed response (learned from much experience with intermittent carriers!) we each took up our telephone handsets and proceded (without avail) to blame the other for not having his telephone "jammed firmly into the modem." Getting nowhere verbally, we decided to place our handsets back into the acoustic couplers and see what would happen. To our amazement, ASCOM picked up where it had left off without missing a beat (or a byte!). BLOCKV has since become our default transmission protocol.

Another nice feature of BLOCKV protocol is that it allows wildcard file names on the SEND command. This makes it possible to send multiple files with a single ASCOM command.

In order to use this capability, the receiving system specifies only a disk drive name on the RECEIVE command, and the transmitting machine uses the SEND command, followed by an ambiguous (wildcarded) filespec. For example, if two computers are using BLOCKV protocol to exchange files and 1) the receiving system issues the command RECEIVE C: while 2) the transmitting machine issues the command SEND B:\*.*, then all the files on the sender's drive B: will be transferred to the receiver's drive C:.

It is vital to ensure that there is enough room on the receiving disk drive to contain all the files. When we once filled up a drive this way, the receiving system told us the diskette was full, but the transmitting system got lost and the transmission could not be restarted.

It should also be noted that if the "RECEIVE [drive name]" command is issued on the receiving end, the SEND command issued by the other partner *must* be wildcarded. If it is not, the transmission will not start.

BLOCKV can also be used with unambiguous filenames, and in this mode a fully specified filename must be used on both the receiving and transmitting end.

If the transmission is to be a multiple-file send, a block consisting of an SOH (01 hex) followed by an 11-character filename and extension, and an 8-bit checksum is transmitted. The receiver responds to this block with an ACK. This block is then followed by a structure block as described for BLOCK protocol, to which the receiver also replies with an ACK.

If this second ACK is received by the sending computer, it will receive the block number of the block being acknowledged. This number is formed as a 6-digit ASCII number with leading zeros converted to spaces. No more than a

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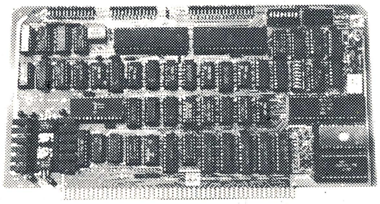

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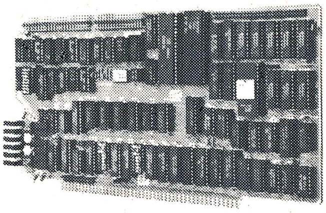

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one-second gap is permitted between the successive bytes of this block number. If the ACK is not received, the block number being acknowledged is compared with the previous block sent. If they are the same, the current block is retransmitted and the remaining blocks are transmitted in a similar fashion. But, if the block numbers do not match, the number of the transmitted block is incremented by one and is again compared. If at this point they are the same, then the receiving station acknowledges the block that was just sent and ASCOM continues to transmit the remaining blocks. However, if the block numbers still do not match, a synchronization error has been found and the transfer is aborted.

If, at any time, no response is detected from the other system, ASCOM will wait silently for 3 seconds and then enter pause/ENQ mode. In this mode, the transmitter will send an ENQ (05 hex) after every 5 seconds of line silence. The receiver should respond with an SOH followed by the number of the last block successfully received. The sender will then go through the block resynchronization procedure described above. If no response appears, the sender will remain in pause/ENQ mode until TIMEOUT seconds have elapsed or until the operator aborts the transfer with Control-C.

On the receiving end, ASCOM will wait for the filename block if it is in multiple-file transmission mode. If the checksum is valid, it will create the specified file and send an ACK response.

ASCOM will then wait for a valid block as described in BLOCK protocol. If an ENQ character is detected, it will transmit a 6-digit ASCII block number and then wait for a block again.

If the checksum for the received block is correct, the block counter is incremented and an ACK character is sent. If the checksum is incorrect, a NAK is transmitted and ASCOM goes back to waiting for a block or ENQ. If no ETB is found at the end of the data block or some other fault is detected, the receiver will wait for 3 seconds of line silence and then enter wait mode until either a character arrives or TIMEOUT seconds elapse. This will cause it to return to waiting for a block or ENQ.

The multiple-file transmission mode of BLOCKV protocol will also erase any files on the receiving system that have the same name as files being transmitted. This is the only protocol in which this is done.

Another strong feature of ASCOM is its customizability. The ASCOM developers evidently assumed that you might someday wish to change or add to ASCOM's features. There are four USER commands for which you can write your own code to configure things virtually any way you wish.

It also has all the hooks needed to drive just about any intelligent modem available, but it comes preconfigured for a Hayes SmartModem. Included with the ASCOM package are sample configuration assembler source files that are well commented and easy to modify. The customization section of the manual is well written and easy to follow. Anyone familar with assembler code can easily customize ASCOM for almost any communications hardware. This is not to suggest that assembler coding is mandatory before ASCOM can be used on a system, since ASCOM is available in several preconfigured versions—IBM PC, Apple with CP/M option, etc.

We didn't succeed in crashing ASCOM even at 9600 baud transfer rates across an RS-232 interface.

Probably the most noticeable and serious drawback of the MS-DOS version of ASCOM is the lack of DOS 2.0 pathname support. The MS-DOS machine we were using has a 10 MB hard disk, and we put ASCOM in its own directory "C:vASCOM". We pointed the PATH to this directory, and then set a different default directory (containing the files we wished to transmit). When ASCOM was invoked, a message was written to the screen indicating that the ASCOMHLP.MSG file could not be found. (This is the distributed ASCOM message file that was also in the vASCOM directory and could have been found if the MS-DOS environment PATH string had been checked.) The program continued to function just fine as long as we didn't want help. The "aha" response was to return to the vASCOM directory as default so that we could use the help facility. Guess what? Now we could get all the help we wanted, but from within ASCOM we could not access files that were in any other directory on the hard disk. Catch-22! Anyone familiar with the benefits of separate directories on a hard disk can appreciate the problem.

We also found that in the IBM PC version, ASCOM takes a long time (about 8 seconds) to return to DOS after the EXIT command has been issued. This is because the EXIT command causes the Hayes SmartModem to execute its HANGUP sequence, which takes up most of these 8 seconds. ASCOM can be customized either to not execute the HANGUP sequence or to exit via one of the USER commands.

ASCOM makes some use of color in its menus, if a color monitor and adapter are available. Unfortunately, if you are using a monochrome composite video monitor with your color display adapter, the image breaks up and the menus become very hard to read. This could be easily resolved with a COLOR option in the configuration section.

We have not covered all of ASCOM's capabilities in this article. For instance, there is a useful set of commands which allows received and transmitted character substitution. The manuals actually describe how to use this feature to convert from EBCDIC to ASCII. There is also a REMOTE option which allows a computer running ASCOM to act as a host system.

An overall evaluation must indicate that ASCOM is a well-written, high-quality piece of software that can be used for almost any serial communication task. The documentation (in the now ubiquitous three-ring denim binder) was clear, easy to reference and understand, and technically accurate.

ASCOM accomplishes its many tasks admirably; we did not succeed in crashing it even at 9600 baud transfer rates across an RS-232 interface. With no interrupt-driven serial ports on the CP/M side this was truly impressive! (In truth, under contrived conditions, we were able only once to get ASCOM totally confused by setting both computers to REMOTE mode. ASCOM couldn't figure out who the boss was and chased its tail interminably.) The choice of protocols and reliability of transfer all add up to a very worthwhile and usable piece of software.

For further information, contact **Dynamic Microprocessor Associates,** *545 Fifth Avenue, New York, NY 10017; (212) 687-7115.*

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RCPM Directory

Continued from page 66

Robesky; M-F 7P-7A, wknd 24 hrs; (3BV;25m); Standard and new CP/M 80/86, 'C', dBASE II, IBM-PC DOS [no answer if in use]
Merced HUG CBBS/RCPM. (209) 383-6417. Clinton Cook; M-Th 6P-12P, wknd 24 hrs; (B2;2M); System powered down until modem lock; Interest in CP/M, modem, Basic programs; (Merced, CA)
San Jose DataTech Node 007 / Piconet Node 003. (408) 238-9621. Al Mehr; (3B;20M); ZCPR2, CP/MUG, SIG/M software
Santa Clara RBBS/RCPM. (408) 247-2853. Jeff King; 8A-11P M-F, 24 hrs wknd; (3;20M)
Oxgate-002 RCP/M Milpitas. (408) 263-2588. Mel Cruts; (system hrs may be erratic due to heat); (1-7;12M); (south SF bay area)
PicoNet #4 Wizard's Keep RBBS-RCP/M. (408) 281-7059. Rick Hobbs; (3;20M); Will answer technical questions on Osborne 1; (San Jose)
Skyhouse Systems. (408) 296-5078. Kirk De Haan; (no answer if in use); (3B;30M); NEW number and format; (Santa Clara)
OxGate-001 Monte Sereno, CA. (408) 354-5934. Chuck Metz & Paul Traina; (3B;20M); (San Jose area)
POTPOURRI BBS & RCP/M Oxgate-012, San Jose, CA. (408) 378-7474. Wayne Masters; (3B;20M); Engineering Applications, Compilers, Assemblers, disassemblers & free JRT Pascal. Special software for sysops on A10; leave name and system phone #.
OxGate-dBASE II RCP/M Campbell, Ca.. (408) 378-8733. Roger D. Brown; (3B;4M); dBASE II is available on this system to demonstrate software from independent software developers. System will soon be converting from OxGate to a BBS written in dBASE II. (San Jose area)
Atlas Micro Associates "MCI" RCP/M-RBBS. (408) 379-8086. Bill Spoolhoff; 7P-10P M-F, 24 hrs wknd; (1-7;2.4M); Investment software, Dbase II, CB-80; NOTE: When system unavailable, you will receive short VOICE message and be disconnected; (San Jose)
COMP-NET RCPM-RBBS. (408) 637-1404. Curtis Elliott; (3;10M); soon to be 1200 bps also; member of the K-Net and running K-NET 84™ system on Kaypro 10.
SIMMS 003: "BAYLIST" System. cb (408) 730-8733. Eric Sarti; (3;256k); Multiple message base. (south SF bay area)
SIMMS 001: Network Headquarters. (408) 732-9190 $. Ed Svoboda; (3B;44M); Silicon Multiple Message System; 1000's of files online. Annual membership donation is $25. Send to SIMMS HQ, Box 532, Cupertino, CA 95015. (South SF Bay)
CrosNest II (DataTech Node 014). (415) 341-9336. Wilbur H. Smith; (3;2.8M); (Box 962, San Mateo, Ca. 94403) CDOS, CP/M hardware/software tipes/bulletins/ educational utilities and communications software (SF Bay area)
RBBS of Marin County. (415) 383-0473. Jim Ayers; M-F 5P-8:30A, wknd 24 hrs; (1-7;10M); Now up with 10 meg drives A:-E:, user areas 1-2 w/ SIGM and CP/MUG pgms; (SF bay area)
Rich & Famous RCP/M. (415) 552-9968. Stephen Price, Ralph Nishimi; (3B;760K); games, communications; (San Francisco)
DataTech Network Headquarters System. (415) 595-0541. Edward Huang; (3BV;1M); (Box 290, San Carlos, CA 94070) Hub of DataTech Network. Heath/Zenith/
TRS-80, utilities and communications software. (SF Bay Area)
Humor and Wisdom. (415) 674-0660. Wayne Webber; (3B;1.5M); Humor, jokes, poetry, insights, etc; also supports software download/upload. (SF Bay Area)
Napa Valley RBBS/RCPM. (707) 257-6502. Dave Austin; (1-7;1.2M); Features: Apple, Atari, Compupro, Morrows, Osborne, TRS, CP/M software; interest in BDS/Aztec C, dBase II, Ham Radio; (Napa)
Fairfield RBBS/RCPM. (707) 422-7256. Mark Bournival; (3(1200 soon);3M); CPMUG & SIG/M, general CP/M software; (Northstar w/ 8" drives); (Sacramento area)
XEROX NORTH COAST RCPM. (707) 725-5230. Michael Mayfield; (3;644K); No answer when in use; Approx 1000 public domain files, B drive changed every 2 days; XEROX 820-II PC Based; (Fortuna)
Critical Mass RBBS/RCPM. (707) 884-4221. Ken Mobert; (3;26M); Oxgate system; (Gualala)
CBBS/Sacramento. (916) 483-8718. Joe Bergin; (3?;??); (Need more info!!)
Orangevale RCP/M. (916) 988-2660. Ken Benedict; (3B;??); No answer if in use. (E. of Sacramento)

Southern California

Los Angeles RCP/M. (213) 296-5927. Bob McCown; (1-7;2.5M); System features catalog of the latest CP/M, Apple, Atari, TRS-80 and IBM PC software; (west LA)
PatVac. (213) 306-1172. "Pavlov's Cat", (Harris Boldt Edelman); (3B;366K); a magazine for the Real Programmer whose defenses are down. Expect to find various flaky logon and menu programs running that are in test phase. System has lacked a bbs program since Nov. '83; this seems to confuse novices. Do Not Be Deterred. (Venice)
ThreePalms MAX BS RCP/M. (213) 430-0079. Rick Edwards; (3B;1.5M);Lobo Max 80 Bulletin System running CP/M Software. Member of MAXIML (MAX-80 Users) (Seal Beach)
Bankers & Hackers BBS/RCPM. (213) 498-6581. Don Appleby; (3B;1.8M); N* system with NZCPR
G.F.R.N. Data Exchange (RBBS). (213) 541-2503. Skip Hansen; (3BV;2.4M); ham radio-related pgms; (Palos Verdes)
Catholic Information Centre (R)BBS. (213) 545-2146. Father John Higgins (3,10M); 8AM-10PMPST. Information on the Catholic Church, question/answer forum for all. (South Bay Area)
ComputerFood Press MBBS/RCPM. (213) 559-9033. Tom Tucker; (3B;382K); Interests include small business systems.
The MAX BS RCP/M. cb (213) 598-7412. Rick Edwards; (3B;1.5M); Lobo Max-80 Bulletin System;

Continued on page 86

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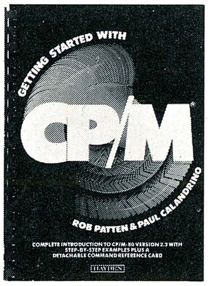
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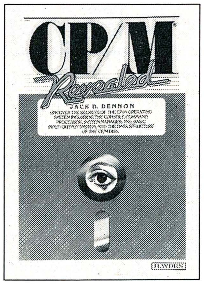

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RCPM Directory

Continued from page 84

TRS-80 and CP/M software; member of MAXIMUL (MAX-80 User's League); callback implemented; (Seal Beach)

El Segundo BBS. (213) 640-2545. Larry Chafe; (3?;???); Games, software demos; (need more info!)

MBBS Headquarters RCP/M. (213) 653-6398. Kim Levitt; (no answer if in use); (3B;382K); System running under ZCPR2; Headquarters for Micro Bulletin Board System™

This system is also a collection point for updates to this list. Please send the information as a file and/or message to sysop.

Southern California Computer Facility. (213) 746-7427. Gene C. Brown;(3,780K;CALL BACK); Unlimited BBS Use, membership required to access RCP/M software. Some software on line.

XANADU. (213) 906-1636. Rick; (3B;4M); CP/M access granted after first call. 9 different interest subboards. (Sherman Oaks, CA)

Los Angeles Communication System. (213) 935-7570. Steve Huntley; (3B;780k); Kaypro based system. Kaypro utilities, CP/M Utilities and communications.

Barstow RCP/M. (619) 256-3914. Bill Wood; (34BV;5.5M); H89 system. (does not see CR's for 8 secs after carrier detect, while system auto boots)

San Diego RCPM. (619) 273-4354. Brian Kantor; (3BV;2.4M); (San Diego)

SABA-HOM-LINE CBBS. (619) 692-1961. Don Saba; (3B;2M); Special interest in Apple CP/M

ASCII ATTIC. (714) 381-2083. Bob Ward; (3B;10M); Kaypro 10 system; (San Bernardino)

Mission Viejo RCPM/CBBS. (714) 495-9384. Bob Mathias; Tue-Sat 7:30P-5A, Sun-Mon 24 hrs; (3B;10M); hobby computing, Ada, and Pascal; Zenith Z100

G.F.R.N. Data Exchange (RBBS) Garden Grove. (714) 534-1547. Doug Laing; (3BV;5M); amateur radio, Apple/CPM; (Garden Grove)

San Dimas RBBS/RCPM. (714) 599-2109. Stu Anthony; M-F 8A-7P, wknd 24 hrs, (try anytime); (3B;964K); Xerox 820-II

AnaHug RCPM/CBBS. (714) 774-7860. John Secor; (3B;10M); hobby computing, ham, electronics hobbyists; Now has 300/1200 212A baud; (Anaheim)

Sit Back and Wackit. (714) 995-2428. Robert Collins; (3B;655K); IBM-PC utilities, 8087 source code; modem programs; APL utilities and hotline; COMPAQ system with 2 RAM disks, 8087 coprocessor and Hayes 1200B modem.

Thousand Oaks Technical RCP/M (RIOS) System 1. (805) 492-5472. Trevor Marshall; (3,36B;66M); Use CHAT to request noise resistant 300 baud modem; active bulletin board, all software released by SIG/M, PC-Blue & Capitol-PC Users Groups on-line. Most CUG vols. 7900+ files on line. Use SYSTAT & MOUNT to access subdirectories. TIME LIMIT now 1 hr/session (multiple sessions OK), increased by 2 for 1 for uploads., New modems. Couldn't get in before? Try now.

Thousand Oaks Technical RCP/M (RIOS) System 2. (805) 493-1495. Trevor Marshall; (3B;65M); No bulletin board, unlimited upload time, download time limited to 15 mins/day, (increased by 2 for 1 for uploads); additional time allocated for program contributors and sysops (policy will evolve as system loading becomes known). (Networked to same 64MB hard disk as system 1.)

Simi RCP/M. (805) 527-2219. Pete Mack; (M-F 7P-7A, wknd 24 hrs); (3-6,B;20M); General interest programs plus special interest in 'C'; Also interested in 88/86 PC software; (Simi Valley)

Gil Berry's Simi RBBS. (805) 527-8668. Gil Berry; (no answer if in use); (3;270K); Apple][system; engineering, robotics, science, music; (Simi Valley)

SIMIAPPLE/RCPM. (805) 584-6054. John Damico; M-F 7P-11P, wknd 24 hrs; (3;6M); interest in modem, rcpm and amateur radio software; (Simi Valley)

LOBO MAX-80 RBBS. (805) 964-6626. Tom Marazita; 24hrs (more or less); (3B;2.4M); MAXIMUL (Max-80 User's League) software, CP/MUG, SIG/M, dBase, PASCAL, 'C'; (Goleta)

Granada Engineering Group RCP/M. (818) 360-5053. Webber Hall; (3;1M); CP/M assembly language programming and technical information; (Granada Hills)

The MOG-UR'S HBBS. (818) 366-1238. Tom Tcimpidis; (34B;19M); 11 different boards, varied interests. Database use welcome to all systems, operating systems and users; (San Fernando valley, LA area)

Pasadena RBBS. (818) 577-9947. Rich Berg; (1-73BV;3.98M); Note: system power off until modem carrier lock. (does not recognize CR's for 15 secs after lock, while system auto boots), Heath H89; (LA area)

Woolf Software BBS. (818) 704-1871. Jeff Woolf; (3;600K); soon 1200 baud & 2M; "MOVE-IT" as well as XMODEM protocol supported; Communications; all welcome.

Northridge RCPM-XBBS. (818) 708-3284. Robert Crump; (3?;???);

La Canada RCPM/RBBS. (818) 790-3014. Chris Hays; (no answer if in use; allow 4 rings for autoboot); (3B;1.3M); electronics, communications software; (LA area)

Altadena RCPM/RBBS. (818) 798-9673. Mark Heriot; (3B;360K); No answer if in use; Osborne 1, TRS-80 PC-2, general CP/M prgms, typesetting interfacing; will help with tech questions about Osborne (ROM or BIOS or actual hardware); (Altadena)

Pasadena CBBS. (818) 799-1632. Dick Mead; (1-7;8.3M); (LA area); (down??)

Xanadu RCP/M. (818) 906-1636. Rick Gaitley; (3B;3.1M); Heathkit H/89 system

Litearia RBBS. (818) 956-6164. Abel Iwaz; (3B;400K); Forum for exchange of ideas on literary topics; Support for Kaypro II owners.

Southwest

Arizona

Valley Technical RCPM. (602) 938-7480. Ed Richardson; (3B;40M); need more info; (Phoenix)

Colorado

The World Peace RCP/M. (303) 320-4822. Alfred K. Carr, Archbishop; (3B;16M); sponsored by the Church of World Peace, Inc.; newest public domain software; MAILBOX message system; legal tax planning; church related info for member churches of the World Peace Convention and church members; no religious affiliation required to use this system; (Denver)

Boulder, Colorado RCPM. (303) 499-9169. Jack Riley; daily 12P-6A, hard disk up 7P-12A Thursday; Keyword-based bulletin board, high-level language software, graphics, numerical analysis & UNIX info,MX-80 graphics, typesetting; (1-7BV;32M)

Colorado Springs RCP/M. (303) 591-8756. Bruce McDaniels; (3B;?). 1pm-11pm, Monday-Saturday only.

Colorado Springs Computer Communications Service. (303) 598-4500 $. Thom Foulks; (3B;2.1M). Members of Colorado Spring User Group only. Online application available.

Pinecliffe RMP/M RBBS. (303) 642-3034. Craig Baker; Irregular hrs, 24 hrs. soon, (try anytime); (3B;16M); Login by using "LOGIN" program. Online databases on such topics as nuclear power, Retrieval system, MP/M-II mods, interest in active discussions; (Pinecliffe)

Denver CUG-NODE. (303) 781-4937. ? Sysop; (1-7;1M)

Lakewood RCPM/RBBS. (303) 985-1108 $. Gary Shaffstall; (3B;38.4M); (300 baud restricted-send SASE to P.O. Box 28146, Sta 16, Lakewood, CO 80228 with up to 6 char password); (Denver area)

Nevada

Reno International (RIBBS) RCP/M. (702) 826-2337. Ron Stevenson & Mike Mcbride; (13;2.4M); EXO noBUS-8 system; Soon (13B;15M); Special sections and nights for different computers; Hotels, Entertainment and Restaurant data base for Reno, Carson and S. Lake Tahoe w/toll free #s for reservations; say ENT; (Reno)

New Mexico

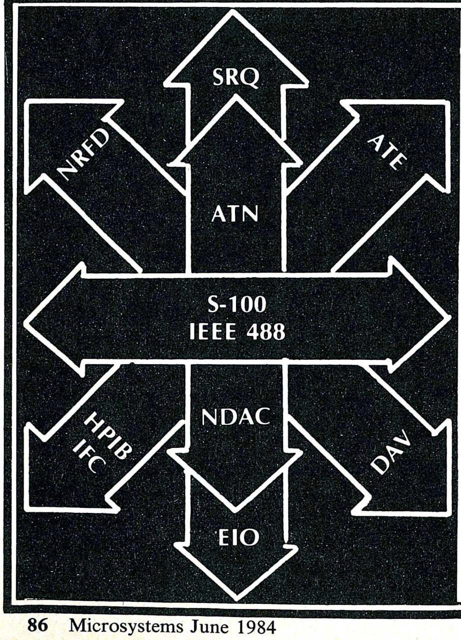
Four Corners RCP/M. (505) 327-2344. Jack Cribbs (?;?) new system, more info needed.

Mesilla Valley RCP/M. (505) 522-8856. Phil Cary; (34B;10M); special interest in CB80; (Las Cruces)

Texas

Dallas RCP/M CBBS. (214) 931-8274 $. Dave Crane; (3B;28M); public domain software and information

Continued on page 88



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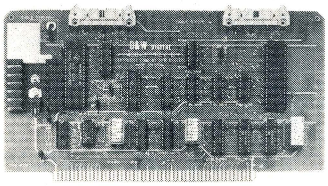

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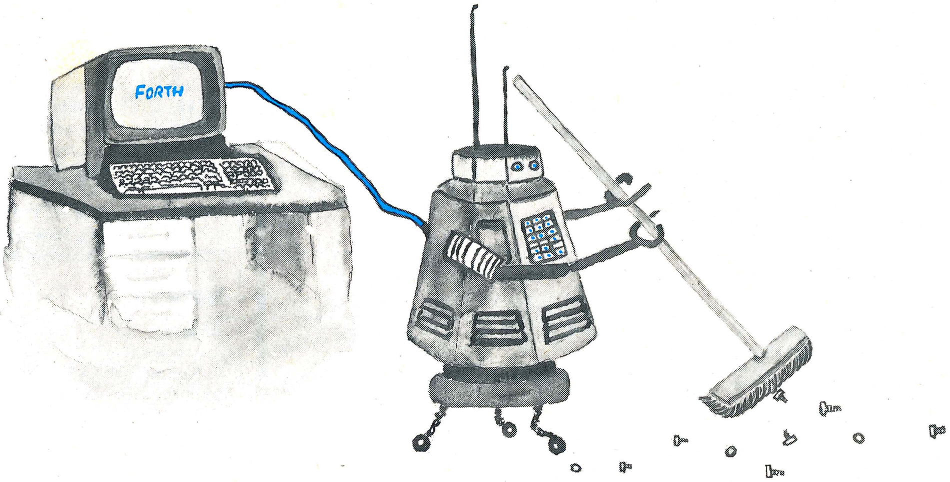

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AUGUSTA, Ada subset compiler from Computer Linguistics for Z-80 CP/M 2.2 systems, $90.00

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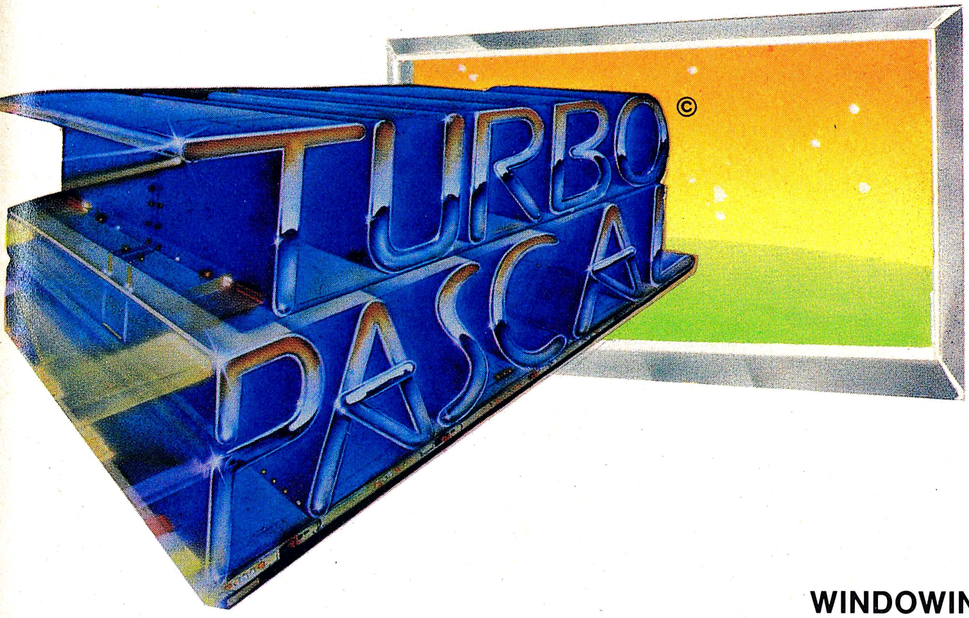

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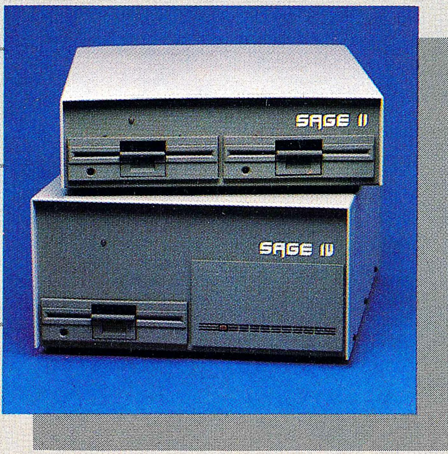

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Gain Remote Access to Your Own System

A simple way to add a remote console

by Bobby A. Jones

So you can't get enough of your computer in the evenings? Well, this article will describe a CP/M 2.2 system that can be run in normal mode or in remote dial-up mode, so you can access your system during your lunch hour at work. Actually, I developed this system for a friend who travels frequently and wants to access his system remotely. It turned out to be a handy feature I also use occasionally for those lingering projects that haunt me for days. The changes to a normal CP/M system are not too complicated, but may require the help of someone who has poked around inside the BIOS and can do some special coding, if you are not inclined that way yourself.

This software runs on a CP/M 2.2 system configured with California Computer Systems hardware (2810 CPU, 2065 RAM, 2422 disk controller) and the DC Hayes 80-103a modem board. You should be able to adapt these ideas to your specific system configuration once you have grasped the underlying concepts of this implementation scheme. The most important consideration in designing a remote computer system is ensuring the system will not "hang" under any circumstances. This may sound easy at first, but believe me, it's not. I have had to go home on several occasions to unhang my system while developing this technique. It's not really a good feeling to hang up and call your system back, only to find the line busy. I always had this vision of a rogue computer dialing all of its international computer friends and charging my phone bill.

To implement this system requires interrupts and some sort of realtime clock to generate these interrupts. My system didn't have interrupts until I added a simple one-chip circuit (Figure 1). These interrupts are used to interrupt whatever program is running (or not running, for that matter) and verify that the caller's modem carrier is still active. This way, if all else fails, the caller can hang up and the system will reboot, clearing up whatever went wrong.

Adding the changes needed to implement the remote modem I/O in a way invisible to the user is a little tricky. You must have a BIOS that has the I/O byte implemented within it. This will allow you to set the I/O byte so as to let console I/O take place via modem.

Then you should add the changes to your BIOS boot and warm boot routines as listed. You must also add the in-

REMOTE CP/M

Continued from page 91

terrupt handler within the BIOS. Now patch your system so that the autoload feature works (*Microsystems*, July/August 1982, p. 64). The autoload command file name should be START. This will autoload the file START.COM whenever the CCP is entered via the first entry point. If the CCP is entered via the second entry point (CCP+3), the initial command is cleared and no autoload occurs. The START file is used to set up the modem and do the remote protocol. This entails waiting for the phone to ring, then establishing carrier control and the needed password validation before giving the system to the caller.

Let's go over all the pieces in more detail to see how they work in harmony. On power-up, the system autoboots if the remote enable switch on the rear panel is in the "open" position. This double-pole switch also enables the 555 oscillator to run, thereby generating interrupts every second. The oscillator's output is latched via the 8212 I/O port, located on an existing I/O board. The 8212's interrupt output is routed to the interrupt pin (73) on the S-100 bus. This

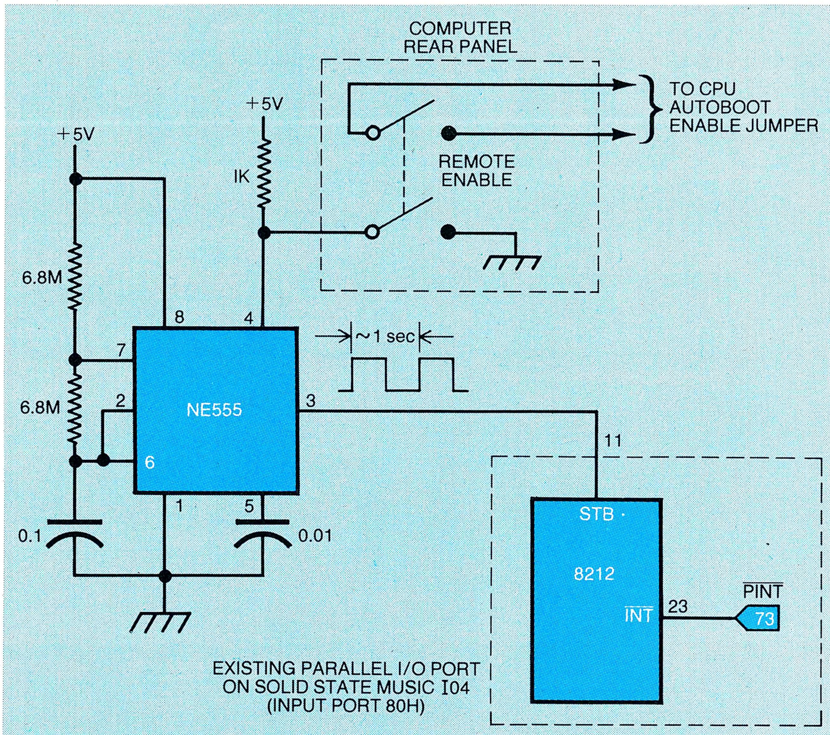

Figure 1. Interrupt circuit.

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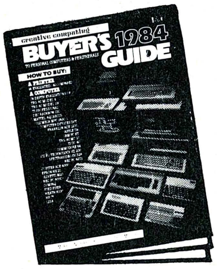

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REMOTE CP/M

Continued from page 92

FIG. 2

```
;***********************************************************************
; ADDED TO END OF COLD BOOT
;
HKFLAG: EQU     8H       ;MODEM HOOK FLAG LOCATION
;
        LXI     H,80H    ;SETUP IOBYTE FOR NO-REMOTE (LIST=LPT:,DISK=A:)
        SHLD    IOBYTE   ;SET IOBYTE, AND CURRENT DISK
        XRA     A        ;CLEAR REG A
        STA     HKFLAG   ;INITIALIZE HOOK FLAG TO ONHOOK
;
; HERE WE DO A JUMP TO WARM BOOT COMMON CODE (USUALLY TOWARD END OF WBOOT)
;***********************************************************************
```

FIG. 3

```
;***********************************************************************
; ADDED TO END OF WARM BOOT
;
DCTRL:  EQU     34H      ;DISK CONTROL PORT (ALSO AUTO BOOT JUMPER)
INTVEC: EQU     38H      ;INTERRUPT VECTOR LOCATION (RST 7)
IOBYTE: EQU     3        ;IOBYTE LOCATION
CCP:    EQU     XXXX     ;BASE OF CCP (THIS IS MEMORY SIZE DEPENDENT)
;
        IN      DCTRL    ;ARE WE RUNNING REMOTE ?
        ANI     40H      ;MASK OFF AUTO BOOT JUMPER
        JNZ     CCP+3    ;NORMAL SYSTEM IF 0 (NO AUTOLOAD ENTRY)
        LDA     HKFLAG   ;FETCH OFFHOOK FLAG
        ORA     A        ;SET FLAGS
        JNZ     CCP+3    ;IF OFFHOOK, ENTER CCP (NO AUTOLOAD ENTRY)
        MVI     A,JMP    ;GET JUMP OP-CODE
        STA     INTVEC   ;SETUP INTERRUPT VECTOR
        LXI     H,INTRP
        SHLD    INTVEC+1
        LXI     H,83H    ;LIST=LPT:,DISK=A,CONSOLE=UC1:
        SHLD    IOBYTE   ;SETUP IOBYTE
        MVI     A,5      ;INITIALIZE TICK BUFFER
        STA     TICBUF
        EI               ;ENABLE INTERRUPTS NOW
        JMP     CCP      ;GO TO CP/M (AUTO-LOAD ENTRY POINT)

;********************************************************************
```

FIG. 4

```
***********************************************************************
        BASIC PROGRAM LOADED WITH WARM BOOT AUTO-LOAD
        ---------------------------------------------

10 REM THIS PROGRAM IS USED TO RUN THE DC HAYES MODEM IN REMOTE MODE.
30 REM WRITTEN BY: B. JONES 4/14/83
40 REM FETCH PASSWORD
50 OPEN "I",#1,"PASSWORD.TXT"
60 INPUT #1,PASSWORD$
70 CLOSE #1
80 REM SETUP MODEM MODE BITS, STOPS, PARITY (8 BITS,1 STOP, NO PARITY)
90 OUT &H91,&H16
100 REM SETUP MODEM CONTROL PORT. (ON-HOOK,MODE,BAUD)
110 OUT &H92,0
120 RINGCOUNT%=0
130 REM WAIT FOR PHONE TO RING THREE TIMES
140 REM ,FIRST WAIT TILL RING BIT GOES LOW
150 WAIT &H91,&H80,&H80
160 REM NOW WAIT TILL RING BIT GOES HIGH
170 WAIT &H91,&H80
180 RINGCOUNT%=RINGCOUNT%+1
190 IF RINGCOUNT% < 3 GOTO 150
200 REM NOW GO OFF-HOOK AND ENABLE CARRIER. (POKE HOOK FLAG AT 8H)
210 OUT &H92,&H83
220 POKE &H8,&HFF
230 REM WAIT FOR CALLERS CARRIER
240 WAIT &H91,&H40
250 PRINT
260 PRINT
270 PRINT
280 PRINT "WELCOME TO REMOTE CP/M COMPUTER SYSTEM"
290 PRINT
300 PRINT "ENTER PASSWORD : ";
310 USERPASSWORD$ = INPUT$(LEN(PASSWORD$))
320 IF USERPASSWORD$ <> PASSWORD$ THEN PRINT "PASSWORD  FAIL" ELSE 350
330 GOTO 300
340 REM WE HAVE A GOOD USER SO LET HIM HAVE THE SYSTEM. (DO A WARM BOOT.)
350 CALL GOCPM
360 END
*************************************************************************
```

FIG. 5

```
;*********************************************************************
;
; INTERRUPT SERVICE ROUTINE (VECTORED HERE FROM LOCATION 38H)
:
```

```
CLRINT: EQU     80H     ;INTERRUPT CLEAR PORT (READING THIS PORT CLEARS)
;
INTRP:  DI              ;DISABLE INTERRUPTS
        PUSH    PSW     ;SAVE REGS
        IN      CLRINT  ;INPUTING THIS PORT WILL RESET INTERRUPT
        IN      DCTRL   ;FETCH AUTO BOOT SWITCH
        ANI     40H     ;ARE WE RUNNING REMOTE
        JNZ     INTRP2  ;REMOTE IF 0
        LDA     HKFLAG  ;FETCH HOOK FLAG
        ORA     A       ;SET FLAGS
        JZ      INTRP2  ;CHECK CARRIER IF OFF-HOOK
        IN      MSTAT   ;FETCH MODEM STATUS, CHECK CARRIER
        ANI     CARBIT  ;MASK OFF CARRIER BIT
        JZ      INTRP1  ;OK IF 1
        MVI     A,5     ;OK HERE (LOAD TICK BUFFER FOR 5 SECS)
        STA     TICBUF  ;RELOAD TICK BUFFER
        POP     PSW     ;RESTORE REG
        EI              ;RE-ENABLE INTERRUPTS NOW
        RET             ;RETURN
INTRP1: LDA     TICBUF  ;LOST CARRIER HERE
        DCR     A       ;FETCH TICK BUFFER & DECR IT
        STA     TICBUF  ;SAVE IT
        JZ      INTRP3  ;DO A WARM BOOT IF 0
INTRP2: POP     PSW     ;RESTORE REGS
        EI              ;RE-ENABLE INTERRUPTS
        RET             ;RETURN
INTRP3: XRA     A       ;RESET HOOK FLAG TO ON-HOOK
        STA     HKFLAG
        MVI     A,1     ;GO ON-HOOK NOW
        OUT     MCNTR
        JMP     WBOOT   ;DO A WARM BOOT
;
TICBUF: DS      1       ;INTERRUPT TICK BUFFER
;***********************************************************************
```

FIG. 6

```
************************************************************************
        PASSWORD FILE STRUCTURE "PASSWORD.TXT"
        --------------------------------------

"MICROSYSTEMS"

THE ABOVE IS THE PASSWORD. IT IS SIMPLY ANY TEXT WITHIN QUOTES FOLLOWED
 BY A CARRIGE RETURN.

************************************************************************
```

FIG. 7

```
************************************************************************
        ASSEMBLE ROUTINE CALLED BY "START.COM"
        --------------------------------------

; ROUTINE TO TRANSFER CONTROL TO CP/M
; WRITTEN BY: B. JONES 4-1-83
;
GOCPM:  POP     H       ;CLEAN UP STACK CAUSED BY CALL
        JMP     0       ;OFF TO CP/M. BOY THAT WAS EASY.
;
        END
************************************************************************
```

FIG. 8

```
;***********************************************************************
; CONSOLE I/O ROUTINES WITH IOBYTE IMPLEMENTATION
;
CO:     LDA     IOBYTE
        ANI     3       ;ISOLATE CONSOLE ASGT
        JZ      TTYOUT  ;TTY ACTIVE
        CPI     2
        JM      CRTOUT  ;CRT ACTIVE
        JZ      BATCO   ;BATCH MODE
        JMP     CUSO1   ;USER CONSOLE 1 ACTIVE
;
LO:     LDA     IOBYTE
        ANI     0C0H    ;ISOLATE LIST ASGT
        JZ      TTYOUT  ;TTY ACTIVE
        CPI     80H
        JM      CRTOUT  ;CRT ACTIVE
        JZ      LPRT    ;LINE PRINTER ACTIVE
        JMP     LUSE1   ;USER PRINTER 1 ACTIVE
;
CSTS:   LDA     IOBYTE
        ANI     3       ;ISOLATE CONSOLE ASGT
        JZ      TTST    ;TTY ACTIVE
        CPI     2
        JM      CRTST   ;CRT ACTIVE
        JZ      BTSTA   ;BATCH
        JMP     CUST1   ;USER CONSOLE 1 ACTIVE
```

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REMOTE CP/M

Continued from page 92

will allow interrupts to occur, and we can reset the 8212 with a simple assembly language input at its port assignment. On autoboot, the system tracks are loaded and the BIOS is entered via the cold boot entry point. Here we load the hook-flag byte to indicate we're on-hook (Listing 1). From the cold boot, we enter the warm boot about midway (we already have the system in memory), and we add some code to both initialize and test our running mode (Listing 2). If we are to run remote and are on hook, the CCP is entered via the autoload point.

The START program is autoloaded at this time (Listing 3). This program was written in compiled Microsoft Basic. It reads the password file, initializes the modem's baud rate, number of data bits, parity, etc., and then waits for the phone to ring. After a set number of rings, the program goes off hook and gives the caller a carrier. At this point the hook-flag byte is set to indicate the phone is off hook. The interrupt routine (Listing 4) looks at this hook-flag byte every interrupt, and if we are off hook the interrupt routine checks the carrier status. If the carrier is lost at any time for five seconds, the interrupt routine will clear the hook-flag, go on hook and do a warm boot. This will cause a new autoload of START, thereby reinitializing everything.

> **The most important thing in designing a remote computer system is to ensure that the system will not "hang."**

If the carrier remains in good health, the caller must enter a password that matches the one read from "password.txt" (Listing 5). The password attempts are not echoed to the

```
;
BATST:  LDA     IOBYTE
        ANI     0CH     ;ISOLATE BATCH ASGT
        JZ      TTST    ;TTY ACTIVE
        CPI     8
        JM      PTRST   ;PAPER TAPE READER ACTIVE
        JZ      RUST1   ;USER READER 1 ACTIVE
        JMP     RUST2   ;USER READER 2 ACTIVE
;
CI:     LDA     IOBYTE
        ANI     3       ;ISOLATE CONSOLE ASGT
        JZ      TTYIN   ;KBD ACTIVE
        CPI     2
        JM      CRTIN   ;CRT ACTIVE
        JZ      BATCI   ;BATCH MODE
        JMP     CUSI1   ;USER CONSOLE 1 ACTIVE
;
RI:     LDA     IOBYTE
        ANI     0CH     ;ISOLATE BATCH ASGT
        JZ      TTYRDR  ;TTY ACTIVE
        CPI     8
        JM      PTRIN   ;PAPER TAPE READER ACTIVE
        JZ      RUSI1   ;USER READER 1 ACTIVE
        JMP     RUSI2   ;USER READER 2 ACTIVE
;
LSTAT:  LDA     IOBYTE
        ANI     0C0H    ;ISOLATE THE LIST DEVICE ASSIGNMENT
        JZ      TTOST
        CPI     80H
        JM      HSPST
        JZ      LPRTS
        JMP     LUST1
;
PO:     LDA     IOBYTE
        ANI     30H     ;ISOLATE PUNCH ASGT
        JZ      TTPNCH  ;TTY ACTIVE
        CPI     20H
        JM      HSP     ;HIGH SPEED PUNCH ACTIVE
        JZ      PUSO1   ;USER PUNCH 1 ACTIVE
        JMP     PUSO2   ;USER PUNCH 2 ACTIVE
;
;**************************************************************************
; MODEM I/O ROUTINES ARE HERE. (FOR DC HAYES 80-103A, S-100 MODEM)
;
MDATA:  EQU     90H     ;MODEM DATA PORT
MSTAT:  EQU     MDATA+1 ;MODEM STATUS PORT
MCNTR:  EQU     MDATA+2 ;MODEM CONTROL REG 2
MRCVR:  EQU     1       ;MODEM RECEIVER READY BIT MASK
MTXR:   EQU     2       ;MODEM TRANSMITTER READY BIT MASK
CARBIT: EQU     40H     ;CARRIER DETECT BIT MASK
RNGBIT: EQU     80H     ;RING INDICATOR BIT MASK
;
; MODEM INPUT ROUTINE
;
CUSI1:  CALL    CUST1   ;FETCH MODEM INPUT STATUS
        JZ      CUSI1   ;READY IF "0FFH".
        IN      MDATA   ;READ THE DATA.
        RET             ;RETURN
;
; MODEM OUTPUT ROUTINE
;
CUSO1:  CALL    CUSTO1  ;FETCH MODEM OUTPUT STATUS
        JZ      CUSO1   ;READY IF "0FFH"
        MOV     A,C     ;DATA IS IN REG C
        OUT     MDATA   ;WRITE MODEM DATA
        RET             ;RETURN
;
; MODEM INPUT STATUS ROUTINE
;
CUST1:  IN      MSTAT   ;FETCH MODEM STATUS
        ANI     MRCVR   ;STRIP OFF RCVR FULL BIT
        RZ              ;RETURN IF NO CHAR READY
        ADI     0FFH AND NOT MRCVR      ;FLAG THAT DATA IS AVAILABLE
        RET             ;RETURN
;
; MODEM OUTPUT STATUS ROUTINE
;
CUSTO1: IN      MSTAT   ;FETCH MODEM STATUS
        ANI     MTXR    ;STRIP OFF TRANS READY BIT
        RZ              ;RETURN IF NOT READY
        ADI     0FFH AND NOT MTXR       ;FLAG THAT OK TO TRANSMIT
        RET             ;RETURN
;
IOER:   XRA     A       ;RESET IOBYTE
        STA     IOBYTE
        LXI     H,IOMSG ;ADDRESS OF IO ERROR MESSAGE
        JMP     COMERR
;
COMERR: CALL    PMSG    ;PRINT IT ON NEW LINE
        JMP     WBOOTV  ;GO TO WARM BOOT
;
IOMSG:  DB      BELL,'I/O ASGT ERRO','R'+80H
;
; EQUATES FOR ADDITIONAL CONSOLE DEVICES
;
CRTIN:  EQU     IOER
CRTOUT: EQU     IOER
```

```
CRTST:   EQU      IOER
BATCI:   EQU      IOER
BATCO:   EQU      IOER
BTSTA:   EQU      IOER
;
;  EQUATES FOR ADDITIONAL PAPER TAPE PUNCH DEVICES
;
TTPNCH:  EQU      TTYOUT   ;UNASSIGNED TELETYPE PUNCH
HSP:     EQU      IOER     ;UNASSIGNED HIGH SPEED PUNCH
HSPST:   EQU      IOER     ;UNASSIGNED HIGH SPEED PUNCH STATUS
PUSO1:   EQU      IOER     ;UNASSIGNED USER PUNCH 1
PUSO2:   EQU      IOER     ;UNASSIGNED USER PUNCH 2
;
;  EQUATES FOR ADDITIONAL LIST DEVICES
;
LUSE1:   EQU      IOER     ;UNASSIGNED LIST DEVICE 1
LUST1:   EQU      IOER     ;UNASSIGNED LIST DEVICE 1 STATUS
;
;  EQUATES FOR ADDITIONAL PAPER TAPE READER DEVICES
;
TTYRDR:  EQU      TTYIN    ;UNASSIGNED TELETYPE PAPER TAPE READER
PTRIN:   EQU      IOER     ;UNASSIGNED HIGH SPEED PAPER TAPE READER
PTRST:   EQU      IOER     ;UNASSIGNED HS PTR STATUS
RUSI1:   EQU      IOER     ;UNASSIGNED PAPER TAPE READER 1
RUST1:   EQU      IOER     ;UNASSIGNED PAPER TAPE READER 1 (STATUS)
RUSI2:   EQU      IOER     ;UNASSIGNED PAPER TAPE READER 2
RUST2:   EQU      IOER     ;UNASSIGNED PAPER TAPE READER 2 (STATUS)
```

FIG. 9

```
********************************************************************************

         TO COMPILE "START.BAS" USING MICROSOFT COMPILING BASIC
         --------------------------------------------------------

BASCOM
*START,START=START/O

         TO LINK "START.REL & GOCPM.REL" USING MICROSOFT LINKING LOADER
         ---------------------------------------------------------------

L80
*START,GOCPM,START/N/E
********************************************************************************
```

caller for security reasons. If and only if the caller succeeds in entering a valid password, the basic program does a warm boot via an assembly language routine called "GOCPM" (Listing 6). This routine is linked with START, using the Microsoft linker. The caller will now have full control of the CP/M system until he hangs up. If the caller does a warm boot (i.e. Control-C), the autoload feature is bypassed, due to entry of the CCP at the second entry point.

If power fails, the system will autoboot and be ready for a remote caller. I have also added a disk timeout circuit to reduce disk media wear while the system is waiting for a caller. To help you implement this remote system, I have included the front end of my BIOS console I/O section. This should help you add the I/O byte in your BIOS, if needed. The modem I/O routines are included (Listing 7). I have have also included a sample of the compiling and linking procedure needed (Listing 8).

Good luck in implementing this remote system. Now you'll be able access your system both day and night; won't your spouse love that!

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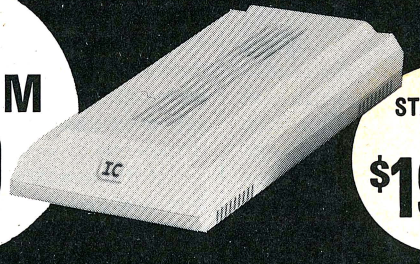

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Interfacing to the 8250 UART

Data rates up to 38.4 kilobauds under full software control

by Mark Zeiger

This article describes a very simple yet powerful dual-channel serial I/O board that can be made for less than $100. It also includes some interrupt-driven software that can be adapted to a number of different needs and uses.

When I needed to write some software for certain modems, I found that my current I/O board, which uses a AY-1013 UART, was totally inadequate for controlling the modems with which I was working. Though a little hesitant to play around with hardware, I decided to build an S-100 board. So I started poring over back issues of *Byte, Microcomputing,* and *Microsystems* for an S-100 I/O board that uses a UART having the RS-232C interface signals needed by most modems.

One thing I wanted the board to have was a simple design to make debugging easy. After looking at the specifications for a number of UARTs (including the Zilog SIO and the Intel 8251A), I decided to use the 8250 ACE (Asynchronous Communications Elements). The advantages of this UART (Universal Asynchronous Receiver Transmitter), in the order I feel most important, are:

1. It has an internal programmable baud rate generator. Therefore there is no need for additional circuitry to implement the programmable baud rate feature I had to have.
2. It monitors and generates all the RS-232C signals that are important when using modems.
3. It is extremely easy to interface to the S-100 bus. In fact, even though I got daring and put a few extra features into the design, my original plan called for only six chips (not including the 8250s). Many of the 8250 interface pins have duplicate lines with opposite polarity, so that inverters are not necessary when connecting the ACE to a particular bus.
4. It has a powerful interrupt structure that makes interrupt generation on the S-100 bus easy to implement.
5. It has 10 registers, which makes software control of the UART very straightforward.

The 8250 ACE does have a disadvantage, however, in that it provides only asynchronous communication. If you must communicate in synchronous mode, you must use a USART (the Zilog SIO is a real fancy one loaded with features; the Intel 8251A does not have as many features, but is smaller and cheaper).

The S-100 interface

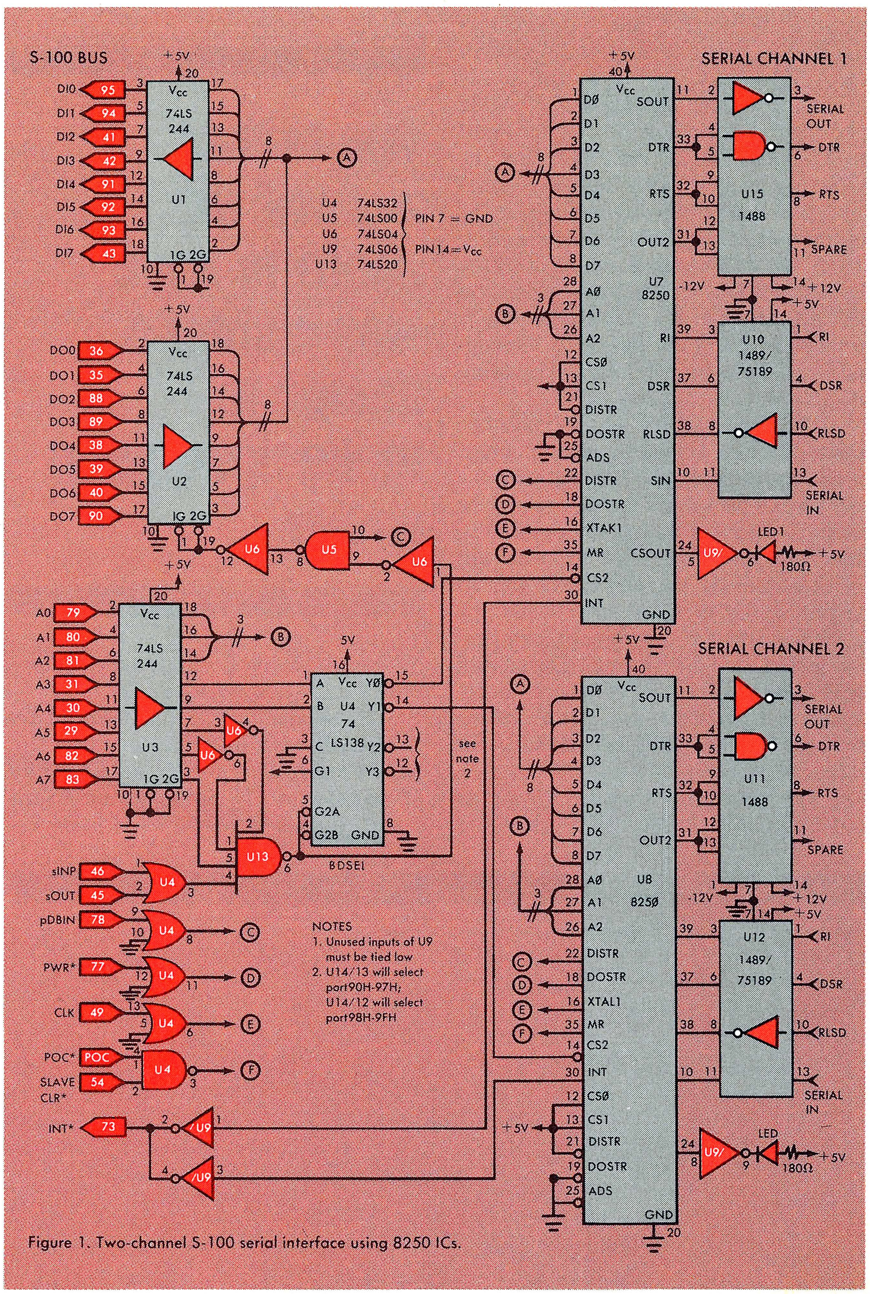
S-100 BUS
+5V
Vcc
74LS 244
U1
U2
U3
1G 2G
DI0 95
DI1 94
DI2 41
DI3 42
DI4 91
DI5 92
DI6 93
DI7 43
DO0 36
DO1 35
DO2 88
DO3 89
DO4 38
DO5 39
DO6 40
DO7 90
A0 79
A1 80
A2 81
A3 31
A4 30
A5 29
A6 82
A7 83
sINP 46
sOUT 45
pDBIN 78
PWR* 77
CLK 49
POC* POC
SLAVE CLR* 54
INT* 73
U4 74LS32
U5 74LS00
U6 74LS04
U9 74LS06
U13 74LS20
PIN 7 = GND
PIN 14 = Vcc
U4 74 LS138
G2A
G2B
GND
BDSEL
see note 2
U13
U5
U6
U9
SERIAL CHANNEL 1
SERIAL CHANNEL 2
U7 8250
U8 8250
DØ D1 D2 D3 D4 D5 D6 D7
AØ A1 A2
CSØ CS1 CS2
DISTR DOSTR ADS
XTAK1
MR
INT
SOUT DTR RTS OUT2 RI DSR RLSD SIN CSOUT GND
U15 1488
U11 1488
U10 1489/75189
U12 1489/75189
SERIAL OUT
DTR
RTS
SPARE
RI
DSR
RLSD
SERIAL IN
-12V
+12V
LED1
LED
180Ω
NOTES
1. Unused inputs of U9 must be tied low
2. U14/13 will select port90H-97H; U14/12 will select port98H-9FH

Figure 1. Two-channel S-100 serial interface using 8250 ICs.

The schematic is shown in Figure 1. The address decoder is the soul of simplicity and not very versatile. I purposely hardwired the port address, since I wanted to avoid complications. However, the circuit may be altered to allow a different base address for the board by using jumper pins. Figure 2 offers an idea on how to do this. If you want to get real fancy, you can put in DIP switches.

As mentioned before, the 8250 ACE has 10 programmable registers; however, addresses need be generated for only seven of them for reasons that will be explained later. Therefore the port selection circuitry generates addresses in groups of eight. I set up the board so that the base port of the first 8250 (U7) is 80H and the second (U8) is 88H. Looking at U13, you'll notice the inputs to the four-input NAND gate are A7, A6 inverted, A5 inverted, *and* (sINP *or* sOUT). Thus when any I/O operation generates an address from 80H to 9FH (binary 100xxxxx, where x = "don't care"), the output of U13 will go low. I use this output as the BDSEL* (board-select active low) signal. This BDSEL* signal enables U14 (74LS138), which is a 1-of-8 decoder (made into a 1-of-4 decoder by tying the most significant input low and ignoring outputs 4 through 7). Address lines A3 and A4 are then decoded to act as chip selects (active low) for four different ACEs whose base addresses would be 80H, 88H, 90H, and 98H. Although I am only using two 8250s on this board, adding more would be extremely easy. The remaining address lines (A2, A1 and A0) are tied directly to the UART and are used to select the read/write registers used in programming the chip.

The tri-state bus buffers (U1 and U2) are necessary on any system where devices share a common bidirectional bus. Note that the "data out" bus driver ("out" relative to the CPU; "in" relative to the UART) is almost always enabled. The "data in" bus is usually disabled, since only one device should be active on a common bus at any one instance. However, when pDBIN becomes active (indicating that the processor is ready to read the data on the data bus) and the board is selected (U13 is low), then the output of U5 becomes low. This enables U1, which allows the data from the ACE to be put on the "data in" lines of the S-100 bus for the CPU to read. At the same time, the outputs of U2 are floated so that there will not be any bus contention on the data bus of the I/O board.

Actually, the circuit could have been made much simpler because the 8250 has an output called DDIS (Driver Disable), which is normally high and goes low only when the UART is instructed by the CPU to write data. This output could be used to enable U1 (and by inverting the output, U2 would be disabled) when the CPU is reading from the device.

The S-100 bus signals pDBIN and pWR* are connected directly to the read/write strobes of the UART. DISTR, the 8250's "data in" strobe, instructs the UART to write data out to the data bus. (The signals are named relative to the microprocessor, which is why DISTR is an output strobe.) DOSTR is the "data out" strobe, which instructs the 8250 to read the data on the data bus. Notice that both of these pins have duplicate inverted inputs. This allows the designer to use the read/write bus signals without having to invert bus signals to meet the chip's needs. Since pDBIN is active high, I connected it to DISTR and made DISTR* inactive by permanently tying it high; pWR* is active low on the S-100 bus, so it was connected to DOSTR*, and DOSTR was connected to ground to disable it.

The 8250 is selected when CS0 and CS1 are high and CS2* is low. Since the 74LS138 outputs are active low (these

UART

Continued from page 99

outputs are used to select the correct UART), I permanently enabled CS0 and CS1 and used CS2* as the actual chip select. I then used the S-100 2 MHz clock signal for the 8250's clock input on XTAL1. The XTAL2 input on the 8250 can be ignored. The other signal that must be permanently enabled is the address strobe (ADS*). This is used to strobe the address line signals onto the 8250 on systems where the valid address is of too short a duration. Since this is not a problem on the S-100 bus, this signal is left permanently enabled by tying it low.

The BAUDOUT signal from the 8250 is a clock whose frequency is that of the transmitter baud rate set by the software. This signal should usually be connected to RCLK (receiver clock) so that the transmitter and receiver will operate at the same rate. CSOUT is an output signal that is active when the UART is selected. I got fancy here and connected each one to an LED that will light up when the particular chip is being used. INT is the interrupt from the 8250. This signal turns out to be of great value, as I'll explain later.

The remaining signals are inputs and outputs to the RS-232C interface. Even though the UART requires only a single power supply (+5V and GND), the 1488 and 1489 line drivers and receivers (75189 on this board) do require +12V and -12V supplies.

One thing I wanted the board to have was a simple design to make debugging easier.

One of the most helpful items in my first hardware undertaking was the book *Interfacing to S-100/IEEE-696 Microprocessors* by Sol Libes and Mark Garetz (Osborne/McGraw-Hill, Berkeley CA). It explains the S-100 signals clearly and gives basic ways of interfacing devices to the bus. Fortunately, the board worked the first time out, so I didn't have to call my hardware-oriented friends. Anyway, they had all left town when they heard I was going to build something.

Programming the 8250

The 8250 has 10 registers, which are summarized in Table 1. Some of the registers are dual purpose with shared addresses. Relative register 0 (80H on my board) has three functions, and register 1 (81H) has two. These functions are used in conjunction with bit 7 (the most significant bit) of register 3.

If bit 7 of register 3 is low, then relative register 0 is the "receive data" register when being read and the "transmit data" register when being written to. Register 1 is the Interrupt Enable register. If bit 7 of register 3 is high, then registers 0 and 1 become the registers that are written to in order to program the baud rate generator.

Baud rates

To set the baud rate generator, the two registers must be loaded with a 16-bit value that, when divided into the input clock frequency (the signal on XTAL1), will give a frequency 16 times the desired baud rate. Assuming a 2 MHz clock (if you're using the S-100 clock on pin 49), first divide the frequency by 16 and then divide by the desired baud rate. This will give you the values to load into register 0 and 1 (when bit 7 of register 3 is a 1). For example, for 1200 baud:

1. 2,000,000/16 = 125,000
2. 125,000/1200 = 104.166666...
   = 104
3. 104 = 0068 Hex

Therefore, perform the following:

```
MVI    A,80H    ;bit 7 = 1
OUT    83H      ;output to relative
                ;port 3
MVI    A,0      ;most significant 8
                ;bits of 0068H are 00
OUT 81H         ;to relative port 1,
                ;which is the most
                ;significant byte
                ;of rate divisor
                ;when bit 7 of port
                ;3 is high
MVI    A,68H    ;least significant
                ;byte of 0068H
OUT    80H      ;least significant
                ;byte of rate divisor
MVI    A,0      ;bit 7 = 0
OUT    83H      ;make port 0 the
                ;transmit and receive
                ;registers and port
                ;1 the Interrupt
                ;Enable register
                ;again.
```

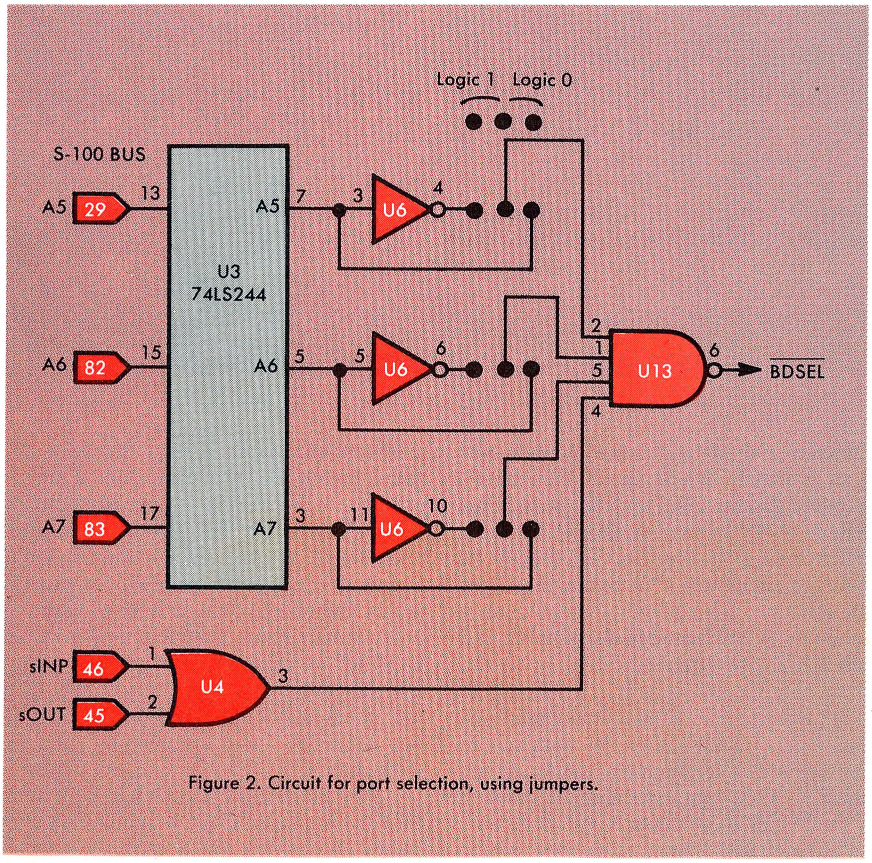

Figure 2. Circuit for port selection, using jumpers.

Table 1. Summary of 8250 accessible registers

	Register Address									
	0 DLAB = 0	0 DLAB = 0	1 DLAB = 0	2	3	4	5	6	0 DLAB = 1	1 DLAB = 1
Bit No.	RBR Recejver Buffer Register (Read Only)	THR Transmitter Holding Register (Write Only)	IER Interrupt Enable Register	IIR Interrupt Identification Register (Read Only)	LCR Line Control Register	MCR Modem Control Register	LSR Line Status Register	MSR Modem Status Register	DLL Divisor Latch (LS)	DLM Divisor Latch (MS)
0	Data Bit 0	Data Bit 0	Enable Received Data Available Interrupt (ERBF1)	"0" if Interrupt Pending	Word Length Select Bit 0 (WLSO)	Data Terminal Ready (DTR)	Data Ready (DR)	Delta Clear to Send (DCTS)	Bit 0	Bit 8
1	Data Bit 1	Data Bit 1	Enable Transmitter Holding Register Empty Interrupt (ETBEI)	Interrupt ID Bit 90)	Word Length Select Bit 1 (WLSI)	Request to Send (RTS)	Overrun Error (OR)	Delta Data Set Ready (DDSR)	Bit 1	Bit 9
2	Data Bit 2	Data Bit 2	Enable Receiver Line Status Interrupt (ELSI)	Interrupt ID Bit (1)	Number of Stop Bits (STB)	Out 1	Parity Error (PE)	Trailing Edge Ring Indicator (TERI)	Bit2	Bit10
3	Data Bit 3	Data Bit 3	Enable MODEM Status Interrupt (EDSSI)	0	Parity Enable (PEN)	Out 2	Framing Error (FE)	Delta Receive Line Signal Detect (DRLSD)	Bit 3	Bit 11
4	Data Bit 4	Data Bit 4	0	0	Even Parity Select (EPS)	Loop	Break Interrupt (BI)	Clear to Send (CTS)	Bit 4	Bit 12
5	Data Bit 5	Data Bit 5	0	0	Stick Parity	0	Transmitter Holding Register Empty (THRE)	Data Set Ready (DSR)	Bit 5	Bit 13
6	Data Bit 6	Data Bit 6	0	0	Set Break	0	Transmitter Shift Register Empty (TSRE)	Ring Indicator (RI)	Bit 6	Bit 14
7	Data Bit 7	Data Bit 7	0	0	Divisor Latch Access Bit (DLAB)	0	0	Received Line Signal Detect (RLSD)	Bit 7	Bit 15

**Bit 0 is the least significant bit. It is the first bit serially transmitted or received. (Table reprinted with permission from National Semiconductor.)*

We can let an assembler do some of the work for us by the following code:

```
LXI   H, 125000/1200
MVI   A,80H      ;make reg 0 and 1
                 ;the baud rate..
OUT   83H        ;..divisor registers
MOV   A,H        ;get MSB of baud rate
                 ;divisor
OUT   81H
MOV   A,L        ;LSB of rate divisor
OUT   80H
XRA   A          ;zero all bits
OUT   83H        ;regs. 0 & 1 back
                 ;communications
                 ;functions
```

Note that 125000/1200 is not exactly 104. There was an error of about 0.16666666. . ., which gives us a relative error of .16666666/104, which is about 0.16%. Because of the way a UART samples serial data, any error of less than 5% is acceptable in asynchronous transmission, so a 0.16% error will cause absolutely no problems. In synchronous communications, such an error would cause problems.

Other 8250 registers

The use of the other register is as follows: Register 3 is used to control the type of serial word the UART will send and hope to receive. Bits 0 and 1 control the word length (5 to 8 data bits); bit 1 controls the number of stop bits (1, 2, or 1.5); bits 3, 4, and 5 enable and control parity; and bit 6 causes a break to be sent as long as it is high (a break is a continuous RS-232C logic 0). Bit 7 has been discussed. In the above programs, it was not necessary to send a 0 register 3 in or-

UART

Continued from page 101

der to set registers 0 and 1 to their communications function. After setting the baud rate, the following would set the type of data word and also turn off bit 7 of register 3:

```
MVI A,3    ;8 data bits, 1 stop
           ;bit, no parity, no
           ;break..
OUT 83H    ;..and reset bit 7
```

Register 4 controls the RS-232C signals whose source is what the RS-232C standard defines as DTE (Data Terminal Equipment). There two auxiliary outputs and a bit that allows the UART to be tested in a "loop back" mode.

Register 5 indicates the status of the receive and transmit data registers. The two most important bits are bit 0 and bit 5. Bit 0 indicates that there is new data in the Receiver Buffer register (read register 0), and bit 5 indicates that the sending register (write register 0) has sent the previous byte and is ready to take a new data word for transmission. The software routines to send and receive are:

```
SEND:     IN  85H
          ANI 20H      ;test bit 5
          JZ  SEND
          MOV A,C      ;get data
                       ;from C-reg
          OUT 80H
          RET
RECEIVE:  IN  85H
          ANI 01       ;test bit 0
          JZ  RECEIVE
          IN  80H      ;input data
          RET
```

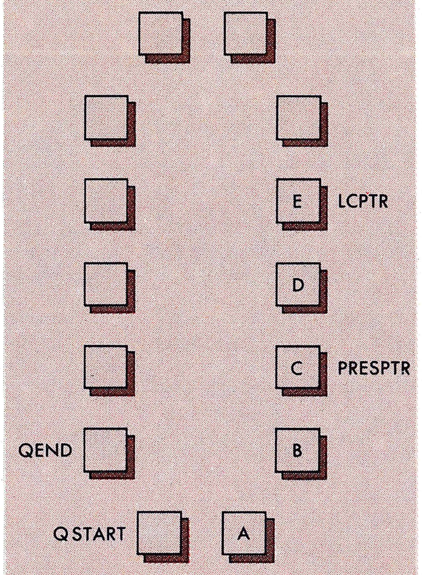

Figure 3. Circular queue containing 5 bytes: A, B, and C have already been sent to console; D and E are pending.

Other bits indicate error conditions (i.e. parity, overrun, or framing errors) or whether a break was detected.

Register 6 indicates the status of the RS-232C signals from the DCE (Data Communications Equipment). The upper four bits indicate the present status, and the lower four bits indicate whether status has changed since the register was last read.

Interrupts

The 8250 can generate interrupts on a number of conditions. The interrupts may be enabled or disabled by register 1 (when bit 7 of register 3 is 0) and the interrupt source may be determined by reading register 2 if more than one type of interrupt has been enabled. In addition, these interrupts are prioritized.

You may wonder why interrupts

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are necessary. I'll give you two examples where they can be useful and show you how this chip handles the interrupts so nicely. I have a very old video board (a Dynabyte Naked Terminal). Even though it is supposed to operate at a speed equivalent to 9600 baud, it feels like it handles linefeeds at something a little less than 2 baud. As a result, when I am using a modem to communicate with a remote system such as one of the many bulletin boards in this area, I lose a lot of characters when my terminal is scrolling. I could ask for nulls, but doing so is very ego-deflating. The sophisticated way of handling this problem is to have the UART interrupt the CPU when a character is received and then place the character in a circular "queue." Then, when things are not so busy, characters can be fetched from the queue and sent to the Dynabyte terminal. A short terminal program with this feature appears in Listing 1. This idea could also be used to implement a type-ahead buffer under CP/M.

The following interrupts may be enabled by setting appropriate bits in register 1. An interrupt may be generated upon any error from register 5 (i.e. parity, overrun, or framing error, or break receive). An interrupt may also be generated when data is received in the Receive Buffer register (this is the type I use to implement the interrupt handler) and when the Transmit Buffer register is empty. Finally, interrupts may be generated when any of the modem status signals monitored by register 6 changes state.

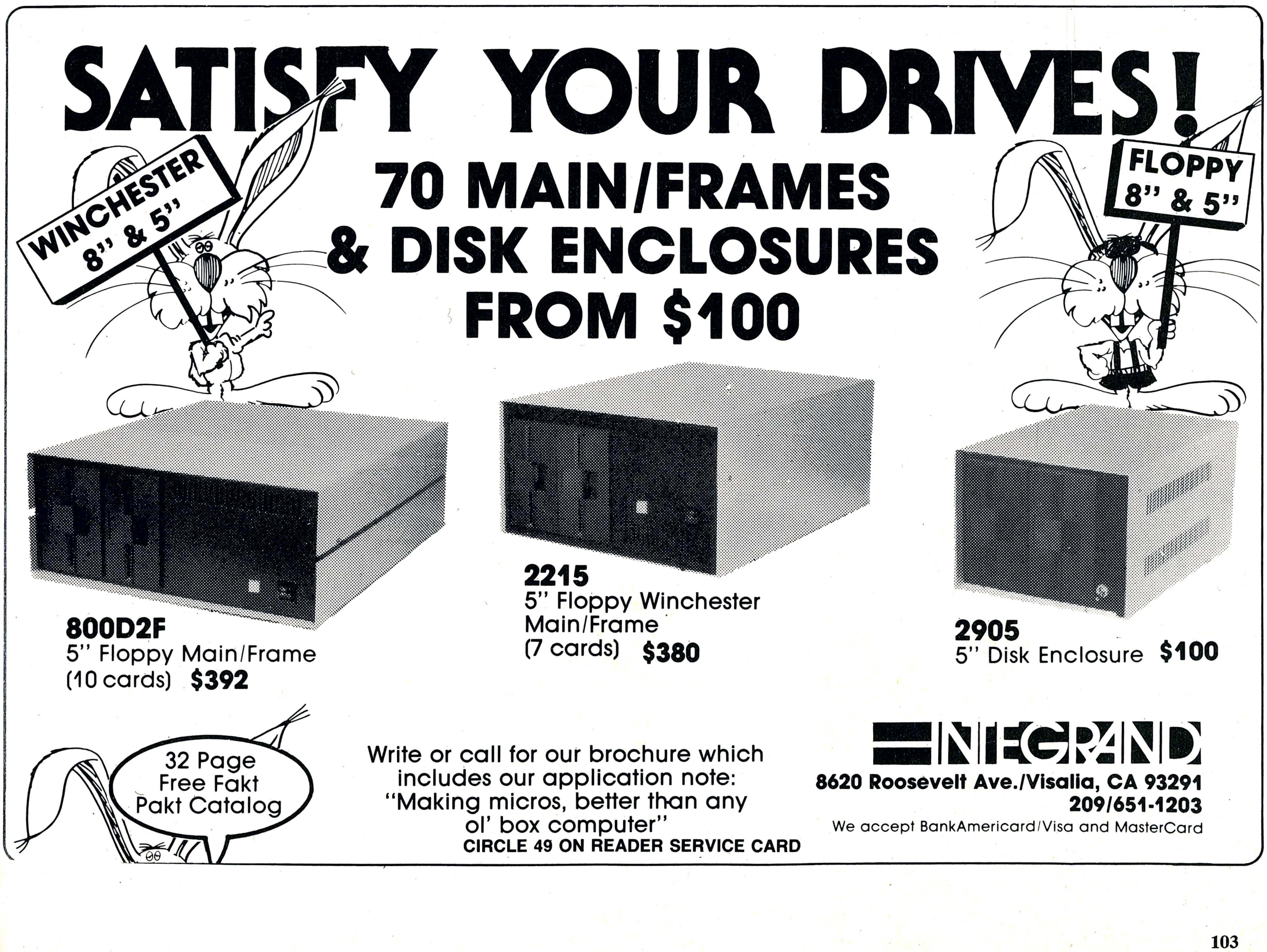
The 8250 has 10 registers, making software control of the UART a very straightforward matter.

This is a very nice feature to have when writing software for communications programs. Most programs must constantly monitor the state of the "carrier detect" signal (called Received Line Signal Detect) to see whether a connection has accidentally been lost. Instead of constant monitoring, just have the UART generate an interrupt if the RLSD input changes state. The interrupt routine would then take care of any problems that occurred because of the lost connection.

Programming the 8250

If the UART were attached to a modem, the program shown in Listing 1 would allow you to communicate with a remote system through the modem. The interrupt queue is explained below. This queue could also be used to implement a type-ahead buffer if the UART were interfaced to a terminal, though certain return codes would have to be altered to conform with the standard CP/M return codes for console status.

To understand the circular buffer, picture a block of memory arranged in a circular fashion. Figure 3 portrays such an arrangement and shows the two pointers used to put data in the queue and get information out. LCPTR points



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UART

Continued from page 103

to the memory location of the last byte put in the queue. PRESPTR points to the character in the queue *before* the one that is to be printed (i.e., the character just printed).

If PRESPTR has the same value as LCPTR, then obviously the last character in the queue has been printed and there is nothing to do, since the queue is empty. However, if PRESPTR is not equal to LCPTR, then it must be "less than" LCPTR, since it's impossible for PRESPTR to ever get ahead of LCPTR. Therefore PRESPTR is increased by one, and the character is fetched into the A register and later printed. The interrupt routine simply reads the UART, increases the LCPTR by one, and places the character from the UART in the address pointed to by the increased LCPTR. The routine is called by an interrupt anytime a new character is in the receive buffer register; therefore, even if the CPU is busy with something else (i.e., waiting for the terminal to scroll), a character can never be lost once it is in the receive buffer.

The 8250 monitors and generates the RS-232C signals that are important when using modems.

The queue is circular because of the **circularinx** routine. **Circularinx** is called with a queue pointer in the HL register (either LCPTR or PRESPTR). This value is increased and then a check is made to see if the increase has taken the value of the pointer past the address that is the end of the queue. If not, the routine returns with the increased value in the HL register pair. If we have gone past the end of the queue (a test made by adding the negated end-of-queue address to the value of HL), then the HL register pair is set to the address of the start of the queue, and we return.

Mark Zeiger, 198-01B 67 St., Flushing, NY 11365

```
title '8250 ACE Interrupts'

        org 100h

acebase equ     80h
bdos    equ     5
cr      equ     0dh
lf      equ     0ah

start:
        lxi sp,stack
        call initialize ;initialize 8250 UART and..
                        ;..set up interrupt vector

;Main program loop

loop:   call keyin      ;returns with char in A-reg..
        push psw        ;..or zero flag set if none
        cpi 5
        jz endpgm       ;reboot if ctrl-E
        pop psw
        cnz serialout   ;if console input then send to UART
        call ckinpbuf   ;see if there is a char in input buffer
        cnz conout      ;if return from "ckinpbuf with zero flag..
        jmp loop        ;..set, then no char ready or "NULL"

endpgm: di
        xra a
        out acebase+1   ;turn off Interrupt Enable Reg in 8250
        rst 0           ;reboot CP/M

;Send byte in A-reg to UART

serialout:
        push psw        ;save char to be sent to ACE
serialoutloop:
        in acebase+5    ;line status register
        ani 20h         ;test Trans Holding Reg Empty
        jz serialoutloop
        pop psw         ;get back char to be sent
        out acebase
        ret

;Character in A-reg to console output

conout: mvi c,2
        mov e,a
        call bdos
        ret

;If no key pressed, return with zero flag set. If NULL
;character, return with zero flag set, else reset zero flag

keyin:
        call constat
        ora a
        rz
        call conin
        ora a
        ret


constat:

        lhld 1          ;address of BIOS jump table + 3
        lxi d,3         ;offset for console status jump
        dad d
        pchl            ;go to CP/M constat routine

;Direct BIOS call to console input

conin:  lhld 1
        lxi d,6         ;offset for console input jump
        dad d
        pchl

;This routine checks the input buffer to see if the address
;of the last character in the queue is the same as the address
;of the present character (i.e. the one after the character that
;was just printed). If it is, then there is nothing to print,
;so return with the zero flag set. Otherwise return with the
;character in the A-reg and the zero flag reset (unless the
;character is a "NULL".

ckinpbuf:
        lhld lcptr      ;compareptrs checks DE and HL to..
        xchg            ;..see if they are the same. Zero..
        lhld presptr    ;..flag set if they are
        call compareptrs
        rz                      ;do nothing if it is
        lhld presptr            ;otherwise increase present..
        call circularinx        ;increases HL modulo (qend-qstart)
        shld presptr            ;resave
        mov a,m                 ;get char
        ora a                   ;reset zero flag (unless ASCII "NULL")
        ret

;Compares (DE) to (HL) and sets zero flag accordingly

compareptrs:    ;sets zero flag if DE equals HL
        push h                  ;HL is changed, but DE is not
        mov a,L                 ;negate HL in order to..
        cma                     ;..subtract HL from DE
        mov L,a
        mov a,h
        cma
        mov h,a
        inx h                   ;HL has been negated
        dad d                   ;HL = -HL + DE
        mov a,L                 ;see if HL = 0
        ora h                   ;set zero flag accordingly
        pop h
        ret                     ;returns with zero flag set

;increases HL modulo (qend-qstart) with qstart as relative zero

circularinx:

        ;Algorithm:     DE = qend    HL = lcptr or presptr
        ;               Subtract HL - DE by doing HL + -DE
        ;               If DE < HL then carry is set
        ;               If DE > HL then carry is reset

        inx h                   ;do the increase then check if..
        push psw                ;..pointer is past end of queue
        push h
        push d

        lxi d,-(qend)           ;get negated end of queue address
        dad d                   ;add it to address of present ptr in queue
        pop d
        pop h
        jnc inxdone             ;if no carry, not past end of queue
        lxi h,qstart            ;if carry set, then past end of queue..
inxdone:                        ;..so reset queue to beginning
        pop psw
        ret

;The Interrupt Routine

interroutine:

        push h                  ;use Z80 EXX and EXAF if..
        push d                  ;..possible. They're faster
        push psw
        in acebase              ;input from port
        lhld lcptr              ;get the pointer to the last character
        call circularinx        ;increases HL modulo (qend-qstart)
        shld lcptr              ;save new pointer
        mov m,a                 ;store character in queue
        pop psw
        pop d
        pop h
        ei
        ret

lcptr:
        dw qstart               ;pointer to last character in queue
presptr:
        dw qstart               ;pointer to location in queue before..
                                ;..character to be printed (char that..
                                ;..was just printed)

;Initialize 8250 ACE

initialize:
        mvi a, (jmp)                    ;first set up interrupt vector
        sta 38h
        lxi h,interroutine              ;address of interrupt routine
        shld 39h

;8080 interrupt mode will work fine if your data bus is terminated
;but to be on safe side, I use:

        db 0edh, 56h                    ;Z-80 interrupt mode 1

;Program is invoked by entering on the CP/M command line
```

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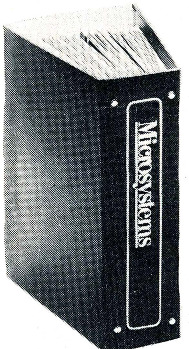

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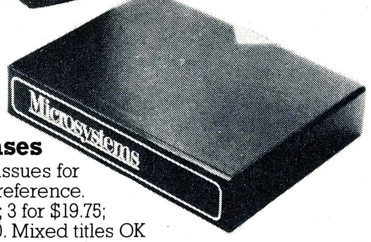

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UART

Continued from page 105

```
;        A>TERM #          where # is either 0, 1, 2, 3, or 4 for
;
;the desired baud rate
;
;Numbers in FCB+1 for each baud rate
;
;                   0 = 110
;                   1 = 300
;                   2 = 450
;                   3 = 600
;                   4 = 1200

        lda 5dh                          ;look at number typed on command line
        cpi 20h                          ;if nothing typed, issue message
        jz nobaudmsg                     ;and reboot
        sui 30h                          ;make ASCII
        jc impropbaud                    ;not a proper baud rate..less than '0'
        cpi 5                            ;make sure not a number over 4
        jnc impropbaud                   ;not a proper buad rate

        lxi h,baudnumtbl                 ;beginning of baud rate divisor table
        add a                            ;double offset for word
        mov e,a                          ;add offset to HL
        mvi d,0
        dad d                            ;HL = addr of word containing..
                                         ;..baud rate divisor

        mvi a,03h                        ;turn on DTR and RTS
        out acebase+4                    ;Modem Control register

        mvi a,80h                        ;set baud rate divisor latch
        out acebase+3
        inx h                            ;MSB of baud rate divisor
        mov a,m
        out acebase+1
        dcx h                            ;LSB of baud rate divisor
        mov a,m
        out acebase                      ;baud rate has been set

        mvi a,3                          ;no parity, 1 stop bit, 8 data bits..
                                         ;...and rate divisor latch off
        out acebase+3                    ;Line Control register
        mvi a,1                          ;enable RDA (DAV) interrupt
        out acebase+1                    ;Interrupt Enable register
        xra a                            ;clear all bits in Modem Status register
        out acebase+6                    ;Modem Status register

        ei                               ;enable Z-80 interrupts
        ret

;Divisors for baud rates on 8250 using 2MHz clock
;
;Divisor = 125000/baudrate for 2MHz clock. If clock frequency is
;different, then use (clock freq)/16 instead of 125000

baudnumtbl:
        dw 1136                          ;110 baud
        dw 417                           ;300 baud
        dw 278                           ;450 baud
        dw 208                           ;600 baud
        dw 104                           ;1200 baud

nobaudmsg:
        mvi c,9
        lxi d,msg1
        call bdos
        rst 0

msg1:   db cr,lf,'No Baud Rate Specified',7,cr,lf,cr,lf,'$'

impropbaud:
        mvi c,9
        lxi d,msg2
        call bdos
        rst 0

msg2:   db cr,lf,'Improper Baud Rate Specified',7,cr,lf,cr,lf,'$'

qstart: ds 50h            ;the circular queue
qend    equ $-1

        ds 50h
stack   equ $-1

        end
```

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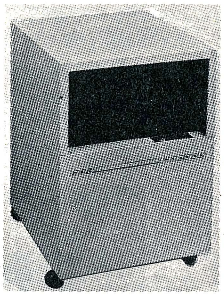

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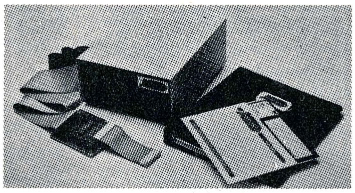

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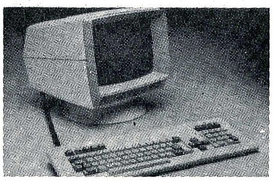

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212 A Modems: A Comparison

Features and capabilities of modern intelligent modems

by Dave Hardy
and Ken Jackson

Probably the most useful piece of equipment that you can add to your computer is a modem. In the past, however, small systems users were limited by price to dumb 300 baud modems. Then in the late 'seventies, intelligent, low-priced modems first became available. Two or three years ago, 1200 baud "smart" modems started to show up, gradually taking over the micro and small systems communication world.

In the last two years, the "smart" modem market has grown substantially, and so has the number of inexpensive smart modems available to micro users. This review is an attempt to cover a representative sampling these of new modems and to give the reader a general idea of the features that "smart" modems offer—including their advantages and disadvantages.

The modems we chose to review were the DC Hayes Smartmodem 1200, the US Robotics (S-100 and Password models), the Racal-Vadic VS212, the Anchor Automation SignalMan Mark XII, the Prometheus Pro-Modem 1200, and the Micro-Baud IV. All of these modems are 300/1200 baud, originate/answer stand-alone RS-232C units (except the USR S-100 version) with autodial capability.

General operation

"Smart" modems can be classified by operation into two different types: menu driven and command driven. The menu-driven types are those which present a menu, or list of options, to the user to allow the selection of some particular function, like dial, answer, select speed, etc. The menu-driven modems discussed here are the Racal Vadic VS212 and the MicroBaud IV.

Command-driven modems are those which accept a command line (i.e., a typed line of information usually ending with a carriage return), then read the command line to determine what functions to perform. The Hayes, US Robotics, Anchor Automation, and Prometheus modems are all command-driven.

Following is a description of each modem, along with a summary of its commands and features. (Command-driven modems are listed first.)

DC Hayes SmartModem

This is the original "smart" modem and is by far the best supported by commercial software vendors and public domain software. Although it costs more than many of the other "smart" modems, it was the first 300/1200 intelligent modem to become popular in the micro industry. It is command driven, and its command set has been copied (or at least emulated) by most of the other command-driven modem manufacturers, including US Robotics, Anchor Automation, and Prometheus. The overall command set consists of the attention signal "AT" followed by one or more of the options shown in Table 1.

The SmartModem 1200 also has an on-line attention signal that defaults to "+++" on reset or power-up and is used to return the modem to the local state while it is still on-line. Using this command, it is possible for the local computer or terminal to send commands to the SmartModem while it is still on-line with a remote modem. This command is more important than it might seem, since it is the only way that a local user can force the SmartModem to hang up the phone, unless his terminal can assert the DTR line. For safety's sake, the "+++" signal must be preceded *and* followed by one second of inactivity, so that any "+++" strings that are sent to the modem for other purposes will not inadvertently force the SmartModem into the local command mode. The time delays and attention character are programmable using the S register commands.

The 17 programmable registers (the Sr commands above) give the SmartModem added versatility by allowing most of the default modem parameters to be changed while in the local command mode. The S registers are shown in Table 2.

When the SmartModem is in the local command mode, it can print the following message or "result codes:"

OK	Previous command line executed properly
CONNECT	Carrier detected
RING	Ringing signal detected on phone line
NO CARRIER	Carrier lost or not detected
ERROR	Error detected in previous command line
CONNECT 1200	Carrier detected at 1200 baud

Hardware features of the SmartModem include a compact metal case, an external power supply, a built-in speaker with a volume control, eight front panel indicator LEDs, and eight configuration switches. The LEDs show high- or low-speed mode, Auto-Answer mode, Carrier Detect, Off-Hook, Receive Data, Send Data, and Terminal Ready and Modem Ready conditions. The eight switches control several power-up options, including:

- Recognize or ignore DTR lead
- Use word or digital result codes
- Send or don't send result codes to terminal
- Echo characters in the command state
- Auto-answer on first ring
- Force Carrier Detect lead to ON state
- Set Telco jack type (RJ11, or RJ12, RJ13)
- Disable command recognition

The RS-232 lines used are as follows:

1	Protective Ground
2	Transmit Data
3	Receive Data
5	Clear to Send
6	Data Set Ready
7	Common
8	Carrier Detect
12	High-Speed Indicator
20	Data Terminal Ready
22	Ring Indicator

US Robotics Password and S-100 modems

These two modems, although radically different in appearance, have basically the same operating characteristics. Their command sets are a subset of the DC Hayes command set and differ only slightly in the register and escape commands. There are no C, H, I, O, or R commands; only S register 0, 2, and 7 are available. The biggest difference is in the function of the "+++" escape command. In the DC Hayes SmartModems, the "+++" command returns the modem to the local command state. In the US Robotics, the "+++"

Table 1. Options for Hayes SmartModem command set

A	-	Force immediate answer
A/	-	Repeat last command line
C0,C1	-	Transmitter OFF or ON
Ds	-	Dial a telephone number; s includes the following:
		0-9
		T - Touch-Tone dial
		P - Pulse Dial
		R - Reverse mode (to call an originate-only modem)
		, - Pause (0-255 seconds)
		; - Return to command mode after dialing
E0,E1	-	Echo ON or OFF while in command mode
F0,F1	-	Set half-duplex or full-duplex
H0-2	-	Force modem on- or off-hook
I0-1	-	Print product code of internal checksum
M0-2	-	Speaker OFF, ON until carrier detected, or ON always
O	-	Return to on-line state
P	-	Pulse dial
Q	-	Quiet mode (no result codes sent to terminal)
R	-	Reverse call modem (same as DR option above)
Sr=n	-	Set the value of register r to n (r=0-16)
Sr?	-	Print contents of register r
T	-	Touch-Tone dial
V0,V1	-	Result codes sent as digits or words
X0,X1	-	Use basic or extended result code set
Z	-	Software reset and restores all default values

Table 2. S Registers for Hayes SmartModem

S0	-	Ring number to answer incoming call on
S1	-	Contains number of rings
S2	-	Escape code character (as in the "+++" above)
S3	-	Character used as a carriage return
S4	-	Character used as a linefeed
S5	-	Character used as a backspace
S6	-	Time to wait before dialing
S7	-	Time to wait for a carrier after dialing or answering
S8	-	Time to pause fo a "," in a command line
S9	-	Time a carrier signal must be received before it is recognized as a carrier
S10	-	Time between loss of carrier and hang up
S11	-	Duration and spacing of tones when tone dialing
S12	-	Time of inactivity that must preceed and follow the escape code sequence ("+++")
S13	-	UART status register
S14	-	Modem option register
S15	-	Modem flag register
S16	-	Test mode

MODEM REVIEW

Continued from page 109

command will cause a return to the local command state *and* an immediate disconnect, which means that you can't return to the local command mode *and* stay on-line.

The US Robotics modems hardware features include a built-in speaker (or a flush-mounted minispeaker on the S-100 version), an analog loopback test switch, a switch to mask the RS-232 connectors pins 5 and 8 or connect them *to* the carrier detect signal, a line equalization switch, and a switch to let the modem read or ignore the DTR signal, pin 20.

The Password model is contained in a small (about 5″ × 7″ × 1″) plastic cabinet with an external power supply. The RS-232 connections are via a built-in cable that has a DB25P connector mounted on its end. Unlike the SmartModem, which requires a cable to connect the modem to the computer, the Password cable can usually just be plugged right into the computer or terminal.

The S-100 model is, of course, built on an S-100 board, so no case is required. All configuration switches in the S-100 version are accessible on the PC card itself, and the speaker is permanently mounted on the board, too, which is convenient for installation, but might make it a bit hard to hear when mounted inside a big S-100 frame. We had no trouble in an IMSAI or Paradynamics frame; however, we noticed two problems in the S-100 version that were not present in the Password. First, the modem had a habit of going OFF HOOK whenever the S-100 machine was reset. Second, the modem seemed extremely sensitive to phone line noise when in the auto-answer mode. When used in an auto-answer installation, the modem would answer the phone several times each day for no apparent reason.

RS-232 lines used in the Password are basically the same as the ones in the SmartModem.

Anchor Automation SignalMan Mark XII

Like the US Robotics, the Mark XII uses a subset of the DC Hayes commands. The Mark XII also has a menu option "AT?" which will print out a menu of most of its options. It does not have the Hayes' M, R or X commands, and uses only S registers S0-S1. However, the Mark XII can do some things that the SmartModem can't—including recognize a dial tone before dialing (by contrast, the Hayes just waits a while and assumes the tone is present) and recognize a remote BUSY signal. Thus, it has two extra result codes, DIAL TONE, and BUSY.

The Mark XII's plastic cabinet is slightly larger than the Password's, and has four LED indicators on its front panel: Modem Ready, Send/Receive Data, Carrier Detect, and High Speed. It also has an extra jack in the back for connecting a standard telephone, which is necessary because the Mark XII has no built-in speaker to let you hear what's happening on the phone line. As usual, an external power supply is plugged into the back of the Mark XII, and RJ-11 jacks are used for the phone connections.

The Mark XII has no option switches or adjustments (except, of course, a POWER switch), although there is a single potentiometer mounted internally whose function is unknown.

One weak point of the Mark XII is its RS-232 connection. Like the Password, it has a cable sprouting out of its cabinet, which in this case is a *ribbon* cable that can be rather easily damaged, although it should be ok under normal circumstances.

The Mark XII uses the same RS-232 pinout as the SmartModem, except it does not have a DTR input (pin 20), which means that you can't force it to hang up with a hardware command. The manual recommends that you just pull the plug or disconnect the phone line if you are unable to issue a software hang-up command (either ATZ or ATH).

Prometheus Pro-Modem 1200

This device is available with two option packages that include a clock/calender, battery backup for its memory, an "on-line" 12-number telephone directory, an automatic receipt/transfer buffer that allows modem operations to be programmed to occur at preset times, a data buffer (up to 64K), and a 12-digit alphanumeric display. In order to make use of all of these features, the Pro-Modem uses a superset of the Hayes command set and result codes. These "extended" commands are usually made either by adding extra values to an equivalent Hayes command (for example, option V3 and V4) or by using the "@" character as a command prefix. Space does not allow a complete discussion of all the Pro-Modem features, but we will try to list several of the more interesting ones.

Because the Pro-Modem has an internal data buffer, it can actually operate to the terminal at 1200 baud while operating at 300 *or* 1200 baud over the phone line. The buffer operations are

Table 3. Partial menu of VS212 menu-driven modem

A	-	Manual answer mode select
B	-	Analog loopback test
C	-	Manual originate modem select
D	-	Dial a phone number
I	-	Go to Idle mode
K	-	Wait 5 seconds for new dial tone
M	-	List the last telephone number stored in memory
O	-	Set option number
P	-	List menu again
R	-	Redial last number stored
T	-	List option table (about 30 options)
V	-	Voice dial (manual dial)

Table 4. Partial list for VS212 selectable options

-	Asynchronous or Synchronous
-	Data Rate Select (use DTR to set speed)
-	Unattended Disconnect
-	Loss of Carrier Disconnect
-	Abort Timer Disconnect for Answering (24 seconds)
-	Respond to Remote Test
-	Auto-Answer on nth ring
-	Duplex
-	Dial Select (Pulse, Tone, or Automatic)
-	Blind Dial (disables dial-tone detect)
-	Call Progress Detection
-	Auto-Redial Counter
-	Voice Detection
-	Response Messages (text or single character)
-	Character Sequence Disconnect Enable (^C, ^D)

controlled with the B command. The Pro-Modem also has a W command to "wait for a second dial tone," which eliminates the need for a "," command when dialing out through a PBX system or using certain ALDS systems. Like the Mark XII, the Pro-Modem can recognize a dial tone and a remote busy signal, too. In addition, the Pro-Modem, when dialing, will try to tone dial, then will try pulse dialing if the telephone exchange doesn't respond to the tones. The @H command will print a HELP directory that comes in handy for remembering all of these commands.

The Pro-Modem has the same status indicators as the SmartModem and basically the same switch configurations, with the exception of an additional switch to force use of Pro-Modem result codes instead of Hayes result codes, and another switch to force automatic redial on busy signal.

The integral clock/calendar is read and programmed via the @T command and includes only month, day, hour, and minute.

Physically, the Pro-Modem is much larger than the other modems discussed here, being about 11″ deep, 6½″ wide, and about 2½″ high. Its front panel is sloped upward at about a 45° angle to facilitate viewing of its LED indicators and displays.

Provision is made to plug in an external telephone, although a built-in speaker and volume control make it unnecessary if just monitoring calls.

The RS-232 connections required are similar to the Hayes, except that no ring or high-speed signals are available. Also, the RTS signal (pin 4) must be used to control buffer flow.

Racal Vadic VS212

This menu-driven modem is available in several different configurations, including a cabinetless OEM version and a stand-alone version. The modem operates in three basic modes: Idle, Data, and Interactive. (There are two additional modes, Test and Voice, which will not be discussed here.) The Idle mode is the normal start-up state of the modem when it is neither on-line nor communicating with its local terminal or computer. When in the Idle mode, the modem can do only two things: answer the phone (if auto answer is enabled), or accept a "wake-up" command from the terminal.

The VS212 is in the Data mode whenever it is on-line and communicating with a remote station via phone.

The Interactive mode is entered whenever the "wake up" command is sent from the terminal. For the VS212, the "wake up" command is Control-E, Return.

After waking up the modem, the operator is met with the response "Hello, I'm ready" followed by the input prompt (*). At this point, the menu may be listed by typing a "P" or a "?". Selections from the menu include, among others, those shown in Table 3.

To change operating speed (300 or 1200) simply go to the Idle mode, change terminal speed, then wake up the modem again with Control-E, Return.

The VS212 can detect dial tones and remote busy signals, and also can automatically select Tone or Pulse dial. This is also the only modem we've seen that can detect a voice answering a call.

The selectable options include (not all are listed here) those in Table 4.
An option switch on the board allows forced CTS, DTR, DSR, and CXR signals. Synchronous operation is possible, and provision for external clocks is made in the DB25 connector.

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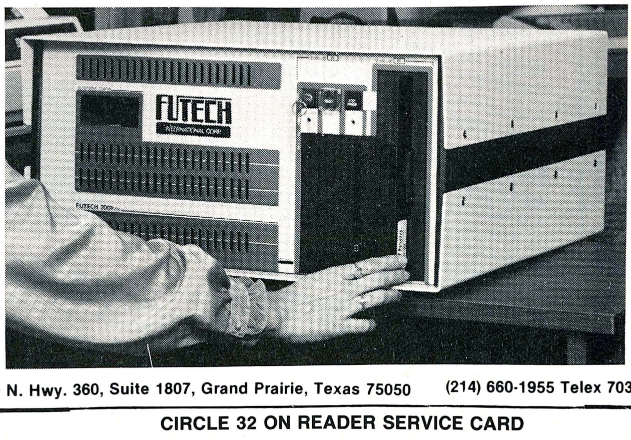

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CIRCLE 32 ON READER SERVICE CARD

MODEM REVIEW

Continued from page 111

2	Transmit Data
3	Receive Data
5	Clear to Send
6	Data Set Ready
7	Common
8	Carrier Detect
12	High-Speed Indicator
15	Transmit clock (needed for synchronous operation only)
17	Receive clock (needed for synchronous operation only)
20	Data Terminal Ready
22	Ring Indicator
23	Speed Select (option)

Micro-Baud IV

Like the VS212, this is also a menu-driven modem. Its commands include:

A	—	Manual Answer
B	—	Blind Dial
Cx	—	Clear a prestored number from memory, or clear B, S, or N parameter (x = 0-5) or B, S, N.
En	—	Dial number n up to 15 times until answer
Lnn	—	Link two numbers for dialing
M	—	Display menu and list stored phone numbers
N	—	Auto-Answer
O	—	Manual Answer
P	—	Use Pulse Dialing
S	—	Turn Speaker ON
T	—	Use Tone Dialing
n	—	Dial prestored number n (n=0-5)
—	—	Pause three seconds

The Micro-Baud IV wake-up command is a Control-E followed by a return, just like the VS212. The modem will respond with "MB212A READY", then list all stored phone numbers. Although it cannot detect a busy signal, it can detect a dial tone. The modem is about the same size as the Hayes and has a voice/data switch on the front panel with only a single "ON" indicator. The modem is disabled when this switch is in the voice position. Also, up to five 32-digit phone numbers can be stored in its nonvolatile memory.

An interesting feature of the Micro-Baud IV is its L command, which allows the modem to dial one number, then dial another if the first number doesn't answer. For example, L14 would dial the number stored in memory 1, then, if no answer, dial the number stored in memory 4.

Option switches allow the Micro-Baud IV to power up configured with auto-answer enabled or disabled, with DTR forced ON or active, and with various test conditions enabled or disabled.

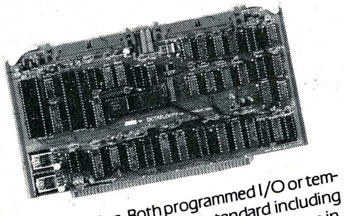
The modem can be made to hang up the phone by either setting the front panel switch to the voice position or lowering the DTR line of the RS-232 connector. There is no way to disconnect from software, since there is no way to get back to the local command mode once a connection is established.

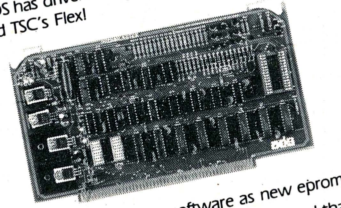
Cost vs. performance

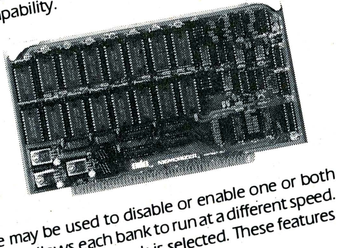
The modems discussed here are representative of the new style "smart" modems available, but there are at least 20 or more other brands available that aren't even mentioned here. The modems covered here range from very low cost to medium cost (about $250 to $700), and cost and ability or performance seem to track well. In other words, the most expensive modems usually do the best job, which isn't entirely unexpected. The Anchor Automation Mark XII and the US Robotics modems may be the exceptions to this rule.

The best way to judge a modem is to actually use it yourself. We have had good and bad reports about every modem discussed here, although we had no major problems with any of them. If it works for you, then it is probably exactly what you need.

Dave Hardy, 736 Notre Dame, Grosse Pointe, MI 48230







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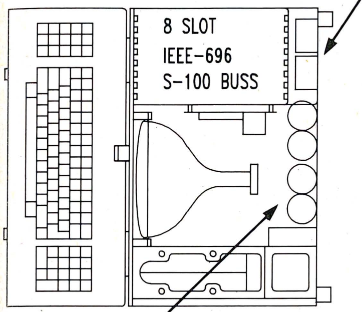

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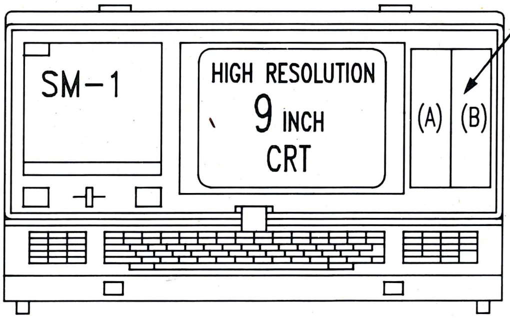

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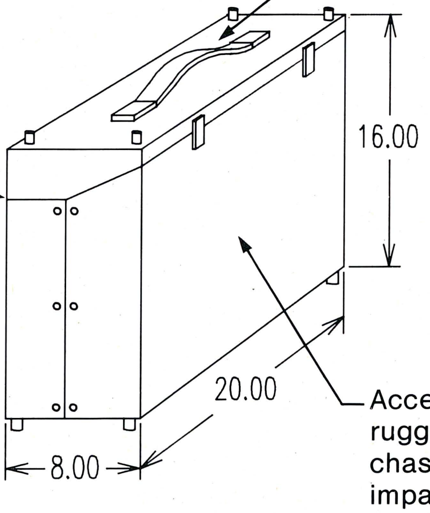

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AT&T Enters the Micro / Mini Market

An extended family of computers uses the same supermicroprocessor

by Bruce Hunter

The thunder at this spring's Comdex clearly belonged to AT&T. AT&T has always been an omniscient presence, their policies unhindered by open market competition and only slightly controlled by government regulation. Each one of us has been directly affected by internal AT&T decisions in one way or another, and usually their policy changes have come down to us as "pronouncements." So it took a while to get used to seeing them at a computer show, in open competition with the rest of the exhibitors.

An old veteran of computer shows large and small, I've always relished the hustle and bustle and the carnival air. Many a successful computer product today started out yesterday as a humble, hopeful venture at a small booth in a computer show. AT&T is hardly "starting out," and their impressive exhibit is indicative of how times have changed. Computers are big business now, and AT&T has entered the free marketplace with some very big guns.

While most exhibitors were clustered in the main hall at the Los Angeles Convention Center, AT&T had a separate exhibition in the next largest area. I have seen entire shows conducted in smaller areas than AT&T's exhibit. Just to give themselves room to talk, they also took the 31st floor of the Westin Bonaventure Hotel, a very posh hotel in downtown Los Angeles. I wasn't surprised to find that AT&T's party was subdued, compared to most. The business of the day was business. One could take pleasant refreshment from a refined assortment of food and a small bar, while an army of grey business suits with the AT&T logo were milling around, ready to answer questions. It was amusing to note that their badges came in gold, silver, and red boldly displaying "pecking order" for anyone interested in that sort of thing.

I was laden down with several slick, glossy AT&T brochures, which, although beautiful to look at and unquestionably expensive to produce, were not technical enough to answer some of my questions, so I eagerly pursued individuals who might help me find the answers. As UNIX Systems Administrator for Interstate Electronics, I have been working with several versions of UNIX on different machines, including a VAX 11/780, a Data General, a Valid for design work, several other minis, and one of the largest UNIX installations in the United

States, UTS (Amdahl's version of UNIX) on an Amdahl 470 mainframe. Unfortunately, AT&T didn't have high-tech people present for the show or the party, so many of my questions remained unanswered. However, I managed to glean quite a lot of information anyway. There is much to tell.

We have all been hearing about UNIX for some time now, and even System V is yesterday's news. What's new is the long-awaited hardware offerings of AT&T. Ever since IBM made its debut with the IBM PC, there has been rampant speculation as to what AT&T would bring out. They chose to present four machines, ranging from super micro to "super-duper" mini.

The processor is a WE 32000, full 32-bit with 8- and 16-bit operations. One of the grey suits informed that the WE 32000 is used across their entire line of computers, and this fact is quite important. Theoretically, if the the bus, memory speed, UART speed, clock speed, and the balance of the architecture are the same, the smallest AT&T machine could run as fast as the largest—an interesting speculation. Both the WE 32000 processor and the 256K memory chips were manufactured by AT&T.

There were many display units at the show and at the hotel where AT&T was having private showings and recruiting potential dealers. Unfortunately, I didn't see a single UNIX system prompt. They were all plugged into cute menu programs instead, which are great for display purposes but useless for indicating of their strength as UNIX machines. Everytime I stepped up to do a Control-D on a demo unit, a representative would stride over and give me a sales pitch. So I can't tell you from personal experience how the machines feel "doing their thing," but I've been offered a demo unit in the near future.

3B2/300

AT&T's computer line begins with a 3B2/300 (3B2 for short) priced at approximately $10,000. Memory is offered in 512K, 1MB, and 2MB options. AT&T is using its own 256K memory chip and fitting a meg on a board. There are only four "feature" card slots, but at a meg of memory per board, there's still room for a few I/O boards. The expansion cards each have four serial RS-232C ports. This unit is supposed to be capable of supporting 18 users when all the card slots are full, but I suspect that some system degradation will occur with more than four users. In general, as the number of users increases, system response time deteriorates exponentially. However, the machine may well be faster than I give it credit for. I sincerely hope that the 3B series does not suffer under user load, but only time and use will tell.

One good way to analyze a computer is to compare it to others of the same or similar capabilities. There are a number of machines in the marketplace with a 10MB hard disk and 256K to 512K of memory. They make passable to very good MP/M or TurboDOS systems, and would make superb CP/M or MS-DOS systems. But UNIX is quite another story. Although AT&T's brochure claims that the 3B2 runs UNIX System V, in actuality the full set of UNIX is not present on this system.

AT&T is giving a new legitimacy to UNIX, thus ensuring its permanence.

This is because UNIX, in its entirety, takes a bit more memory. Actually, it depends on what you define as UNIX. The heart of the system, the kernel, must be in residence at all times. After that, you can "shoehorn" enough of the rest of UNIX to fake it into 256K of high-speed storage and 10MB of rotating storage. IBM has done it on the PC/XT with their own single-user System V, PC-IX. Remember, IBM furnishes its PC-IX system on 13 double-sided floppies. It makes you think. (It should also make you wonder how you are ever going to back it all up!) But if you want uninhibited UNIX with enough room to create files of your own and run processes on a time-sharing basis, you will need at least 512K of good, dependable memory and 20 to 30 MB of hard disk.

The full set of UNIX takes a lot of memory for many reasons. First of all, it uses on-line manuals instead of help files, and there are three volumes of UNIX Programmer's Manuals. UNIX commands, subroutines and system calls number around 500, and that takes a lot of memory. Many of the UNIX utilities have their source code resident on disk as well, because it is sometimes necessary to modify these commands. Also, main memory is taxed under UNIX because it is a very large operating system compared to MP/M or TurboDOS. All this should be taken into account when considering the 3B2.

The 3B2 is a desktop unit. If I were to put it on top of my 20-card CompuPro enclosure, it would resemble an oversized modem. It is less than 4″ high, the other dimensions being roughly 20″ × 17″. With the cover off, you can see how the unit is divided into four areas: the DSDD 5.25″ floppy, the 10MB hard disk, the very small card cage, and the equally small power supply. With a small multiuser machine like my Gifford 421, I am more comfortable with a transformer that is slightly oversized, just to be on the safe side. When a transformer gets too hot, it frequently takes the boards with it. Some pertinent answers about the adequacy of the power supply for the 3B2 would be helpful.

It is interesting that the 12- to 20-slot S-100 card cage—the primary component of today's state-of-the-art large micro—is yielding to faster buses and smaller card cages. Large memories on a card are reducing the need for as many card slots. Static memory, which in the past has been associated with reliability, is yielding to the more compact and efficient dynamic memory, frequently with the use of UPSs (Uninterruptible Power Supplies) to give it the reliability previously offered by static memory. The trend towards miniaturization, starting with the introduction of transistors, has not diminished. Computers continue to get smaller, as the 3B2 aptly shows. The 3B2 has approximately the same computational capability as my Gifford 421, while having less than a quarter of the volume.

3B5/100 and 3B5/200

There is a noticeable gap between the 3B2 and the 3B5, the 3B5 being a lot more computer. AT&T calls it a super-mini, but it is probably more accurate to refer to it as merely an "enhanced" mini. Priced at around $60,000, it is supposed to accommodate up to 60 users, but I have seen bigger machines like Data Generals and DECs go off into never-never-land with half that number. Again, if you are considering purchasing this unit, some pertinent information about performance with 60 users is in order.

Unlike the 3B2, the 3B5 has an abundance of card slots and disk memory. Conventional tape drive(s) are available, and a cartridge will also be available very soon. AT&T is aware of the minor deficiencies of the 3B2 (no cartridge backup, no alternate larger Winchester yet) and 3B5 (only lacks cartridge backup), but these are relatively minor problems and should all be solved by the 4th quarter of this year.

The 3B5 is the size one expects of a

AT&T 3B SERIES

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mini, and it's a fine machine. It's about 30 cubic inches, and the enclosure is strongly built and substantial in appearance. All components are readily accessible from the front panel. The unit can be stacked with similar units and tape drives into a very impressive mini indeed. The 3B5 is in direct competition with the DEC VAX 11/750 and Data General MV 8000. Traditionally, this size of mini is where you expect the most performance for the money.

3B20S

Priced at approximately $100,000, this machine compares to the DEC VAX 11/780 and Data General MV 10000. In fact, it is in direct competition with these machines. It will be intriguing to watch the effect of this competition from AT&T in the future. Like all the AT&T machines, the 3B20S runs on the 32-bit WE 32000. Clock speeds are just short of 10 MHz, and a half million instructions per second (½ mip) is the claimed speed.

3B20D

For now, this is the top of AT&T's line. If the 3B5 and the 3B20S are super minis, then the 3B20D is a "super duper" mini (micromaxi). In other words, it is a very special machine. All of the other machines run on conventional UNIX System V. The 3B20D runs on one of the most unusual operating systems in existence: a *realtime* version of UNIX.

By definition, UNIX is a time-sharing system, and as such, everything goes into the queue. But the 3B20D was developed for switching applications with realtime requirements, and who knows switching operations better than AT&T? It prioritizes by giving differing time intervals rather than priorities. Realtime systems are those which operate on instructions within a few microseconds of receiving them. This technique contrasts with time-sharing systems, which place requests for service in line or "on the queue," and batch systems, which get around to each job when the system and the operator are good and ready.

Another exciting feature is its ultrahigh reliability. It has two power supplies that provide power to the batteries which, in turn, power the system. Power is guaranteed uninterruptible, and clean as only a battery can supply it. Almost every component comes in duplicate, so the machine will operate while being repaired, updated, shuffled, and otherwise "beat" upon. AT&T claims the total downtime per year can be measured in minutes. Just let your imagination run wild while thinking of applications for a realtime super computer under a UNIX system that is never down.

Conclusions

AT&T has covered the computer systems field from an area a little above the IBM PC/XT running PC-IX and others of that class, to the area just under the mainframe class. That is one heck of a lot of ground. Again, there is a wide gap between the small super micro, 3B2, and the 3B5 mini. However, that gap is already well filled by competing supermicros and microminis. Most of these are 68000 machines, with a few exceptions like DEC's micro LSI11. We all know that Digital Research is porting UNIX to the Intel 286, and it is targeted for "gap" area as well.

Callan, IBC, Ithaca Intersystems, Perkin-Elmer, Valid, Altos, Apollo, Charles River, Corvus, Dual, Hewlett-Packard, NCR, Onyx, Plexus, Tandy, and Zilog are only a few of the companies offering UNIX systems in the supermicro/micromini range. I can only speculate that AT&T will eventually fill this gap with a 3B3 or 3B4. The difference between an 18-user machine and a 60-user machine might not seem like that much, but there is very much of a gap between a box that fits under your arm comfortably and a unit that would make Arnold Schwarzenegger stagger under its weight.

The competition in the supermicro and micromini range continues to be brisk. AT&T is facing some real competition, a change from the days when they were in the phone business. Although UNIX originated at Bell Labs, many enhancements have been added to UNIX outside of AT&T, such as the Berkeley Shell and the other Berkeley enhancements. AT&T does not offer the Berkeley Shell, or any of these enhancements, with their systems. But several 68000 competitor machines running UniSoft UNIX ports have not only System V, but also the Berkeley Shell, other enhancements to UNIX, and even a good choice of languages. Recent computer science graduates expect to find the Berkeley Shell and other UNIX enhancements that they have come to know and love at school, and become upset if these are not present. This may present a knotty problem for AT&T in marketing their systems. It is conceivable that AT&T may have to adapt popular UNIX enhancements, such as the Berkeley Shell, incorporating them as

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AT&T 3B SERIES

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part of their "standard" UNIX set.

There is an uncomfortable problem existing in the UNIX market today. Precisely what is UNIX? I consider UNIX to be all those commands, subroutines and system calls found in Volumes 1, 2 and 3 of the standard distribution. Enhancements like the Berkeley Shell, **sccs**, **termcap**, and **ingres** are frosting on the cake. But what about IBM's PC-IX? That is only a subset of UNIX, but how many people know that when they purchase the system?

XENIX is also a subset, and there are many other UNIX subsets on the market. Even the UNIX offered on AT&T's 3B2 system is only a partial set of UNIX, lacking some of UNIX's program development tools. I just do not believe that anything less than the full set of UNIX should be offered as UNIX. Anything less than the full set should be openly advertised as a *subset* of UNIX. Industry standards groups, such as /usr/group, have proposed a set of standards for UNIX. This is definitely a step in the right direction.

In the meantime, even AT&T UNIX is not perfect. One specific failing of AT&T UNIX is the lack of record locking. UniSoft has already come to grips with this problem and has had record locking for some time now. AT&T plans to offer record locking in their next release, System 5.2.

Like any new computer system, the AT&T machines initially suffer from a lack of software, particularly applications software of the type to which users are accustomed on personal computers. Source code in UNIX is portable, but object code is not. Software object code written for the 68000 will not run on the 286 or 30000. A lot will depend on public and industry acceptance of both AT&T's hardware and the continued proliferation of non-AT&T UNIX-based systems and UNIX look-alikes.

Nevertheless, by actively entering the computer systems market, AT&T is giving a new legitimacy to UNIX, thus ensuring its permanence as a standard operating system for some time to come. Bell Lab's innovative operating system was already generating tremendous interest and industry involvement, but now we all know UNIX is here to stay. I, for one, am glad to see this happen.

In addition, AT&T's entrance into the hardware market offers a lot more than four more computers. AT&T has been in the communications business for years, and do their machines communicate! They communicate with each other and with other computers as well.

Smaller machines like desktop and personal computers running under CP/M or MS-DOS can be tied to AT&T's 3B series computers to form an interconnected system much more easily. This means that files can be easily exchanged to increase the versatility of existing machines. As far as UNIX-to-UNIX communications among AT&T and non-AT&T machines, the **uucp** facility of UNIX (UNIX-to-UNIX copy) is certainly one of UNIX' better features, and makes implementing this type of communication a faster and simpler process. Intelligent local area networks are part of the 3B series scheme, including 3BNET (Ethernet) compatibility. It is one thing to talk communications, but it is quite another to implement it. Purchasing systems with communications capability built in is a distinct plus.

It is difficult to make hard predictions on the marketing potential of the four new AT&T computer systems, but I suspect that the AT&T 3B series will do very well, ultimately dwarfing the success of the IBM PC. All ingredients for success are there: a fine and well-accepted operating system; good, fast and compact hardware; and very realistic pricing. Only time will tell. ◼

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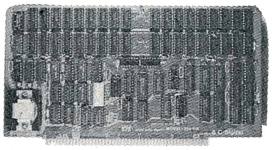

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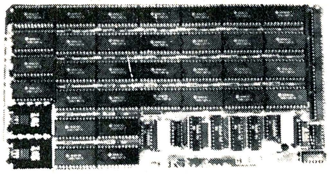

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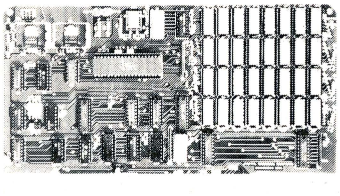

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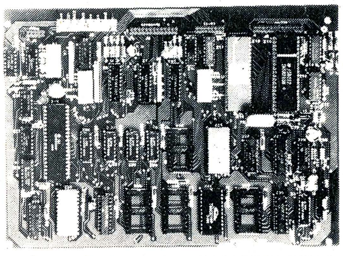

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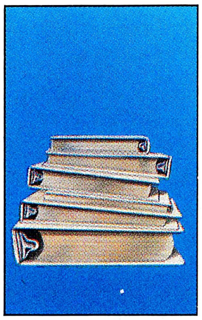

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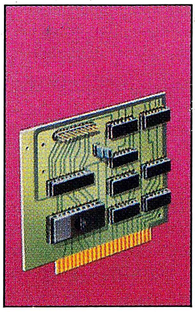

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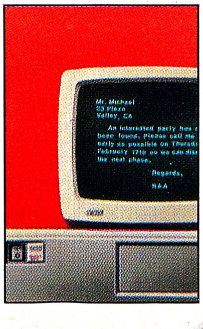

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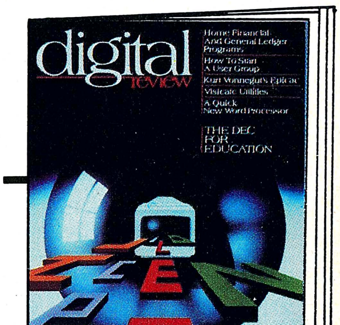

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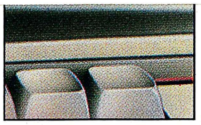

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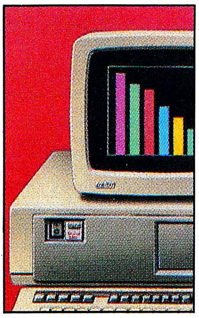

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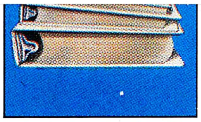

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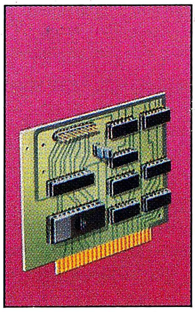

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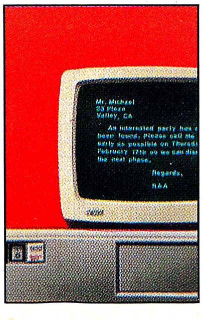

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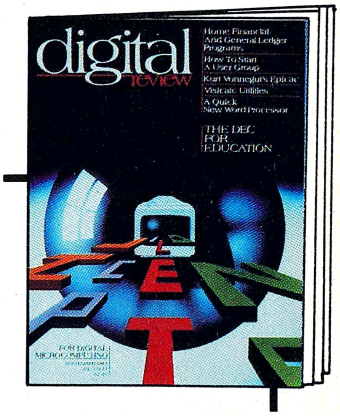
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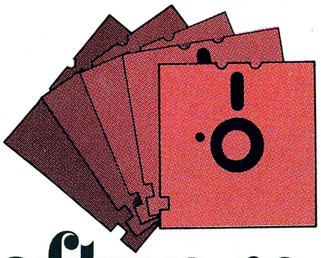

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Minimum memory: 128K
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Perfect Link can also transfer files via modem to practically any computer system, utilizing the Christensen protocol.

Price: $149
Available from:

Perfect Software, Inc.
1400 Shattuck Ave.
Berkeley, CA 94709
(415) 527-2626

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Program name: CO-MAIL
Requirements: IBM PC, Apple II/II+/IIe or any CP/M compatible
Minimum memory: IBM—56K; Apple—64K; CP/M—56K
Description: CO-MAIL is a complete software package for formatting and transmitting E-COM messages from any microcomputer. E-COM (Electronic Computer-Originated Mail) is a first-class mail service offered by the United States Postal Service, providing 48-hour delivery at a cost of only 26¢ per single-page letter. With CO-MAIL, any microcomputer user can transmit business or personal letters directly to Postal Service computers for E-COM delivery. CO-MAIL includes a text-formatting module that supports all E-COM features, and a communications module for both autodial and manual modems. A special feature of CO-MAIL is a preview option that permits the user to print a copy of his letters in final E-COM format prior to transmission. All CO-MAIL options are presented in a menu form. Single letters or bulk mailings of any size can be transmitted without the need for intermediate files. The CO-MAIL user is therefore not limited by the available storage on his computer, and transmission is done more efficiently than with separate formatting and communications programs.

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Included with price: user's manual and E-COM certification materials
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(703) 620-5835

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Program name: ACOM
Requirements: any IBM PC with an asynchronous port
Minimum memory: 64K (all versions)
Description: ACOM (Asynchronous COMmunications) is a data transfer utility program that will neither loose nor mutilate data it transmits. Tests have shown that even if a line drops, a plug is pulled or a modem is jarred during file transfer, the quality of the transmission is still assured. Three versions of ACOM are available: ACOM—a terminal emulator with no file transfer capability that allows an IBM PC-XT to emulate a 3277, 3278 or 3279 (with color monitor and adapter) device when attached to a HyDra II Protocol Converter. No protocol converter is required for ACOM to allow an IBM PC-XT to emulate a DECVT52/VT100; ACOMFT—allows an IBM PC-XT to transmit files to another IBM PC-XT; ACOMHFT—the mainframe software for ACOMFT to transmit or receive VSAM/ISAM/SAM files to or from an IBM or PCM host mainframe.

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BYTE AUG 1983
Houston, Brodrick, Kent

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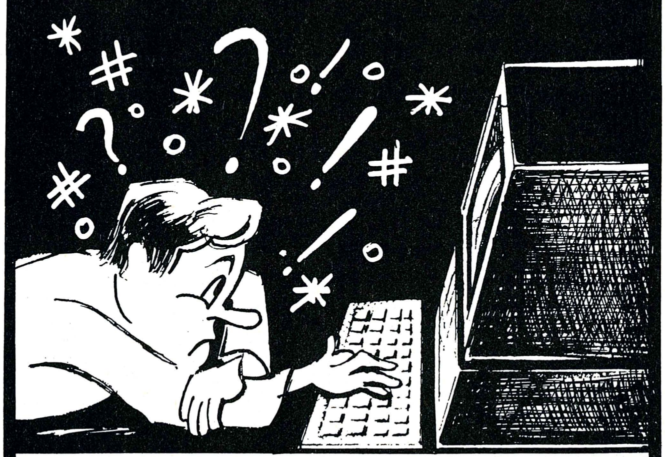

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SOFTWARE

Continued from page 122

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Program name: Preview-Pak
Requirements: IBM PC or compatible
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Available from:

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Program name: General Accounting Programs Package
Requirements: any microcomputer running PICK, UNIX, or having a standard C Compiler.
Miniumum memory: 128K
Language: C or Databasic
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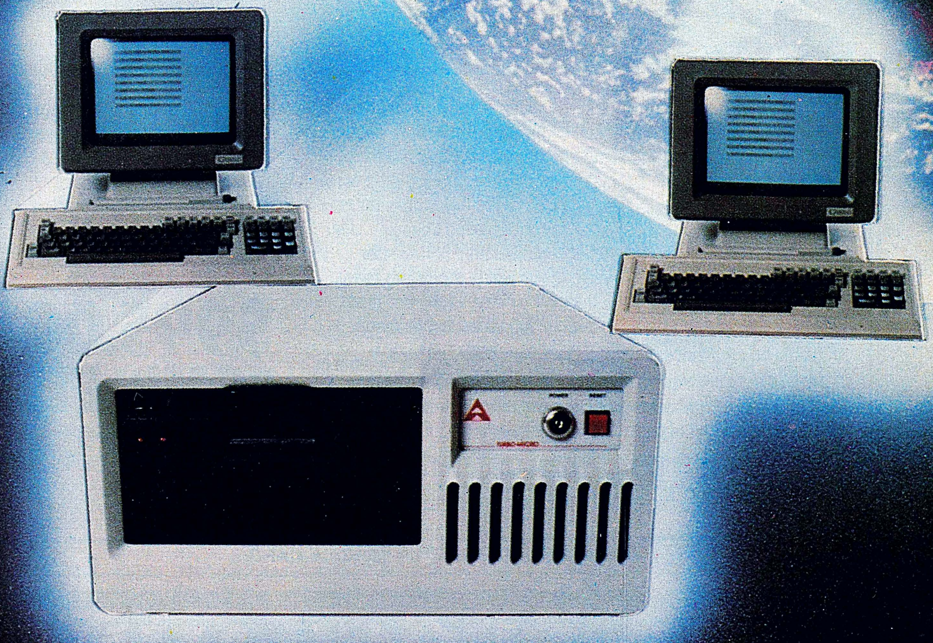

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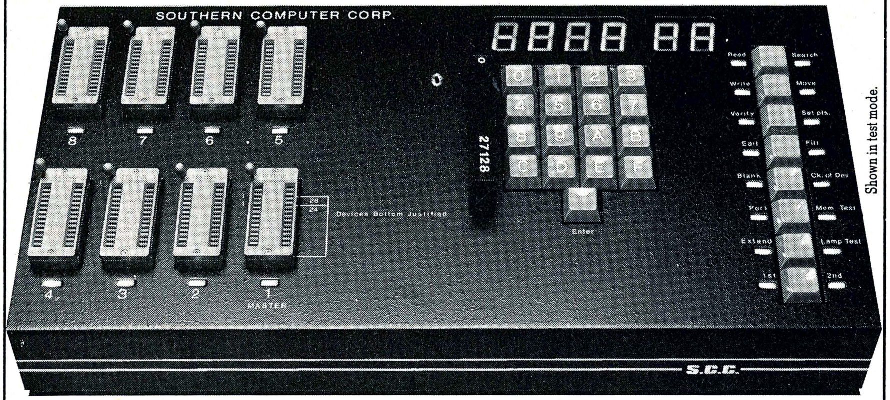

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SOFTWARE

Continued from page 124

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Assume use of compiler and typical editor. What commercial or public domain products, what techniques improve productivity? "Productivity with MSDOS" is a growing document with some answers. Call to request it. **Help improve it. Earn $50** credit toward any purchase when we add any description, code, or idea received from you.

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Desmet by CWare - Fast	8086	109	99

BASIC	ENVIRONMENT		
Active Trace - debug	8080/86	$ 80	72
MBASIC-80 - MicroSoft	8080	375	255
BASCOM-86 - MicroSoft	8085	395	279
CB-86 - DRI	CPM86	600	439
Prof. BASIC Compiler	PCDOS	345	325
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C INTERPRETERS for MSDOS - Ask about one for beginners for $85 or full development for $500.

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MS FORTRAN-86 - Meg	MSDOS	$350	$255
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LANGUAGE LIBRARIES			
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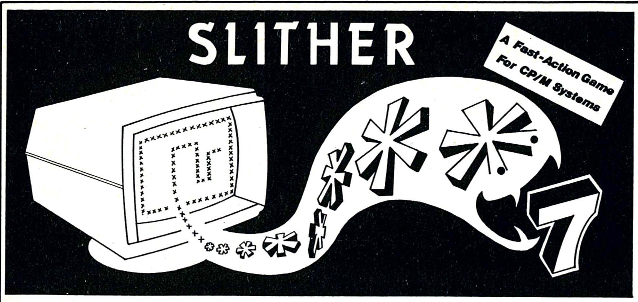
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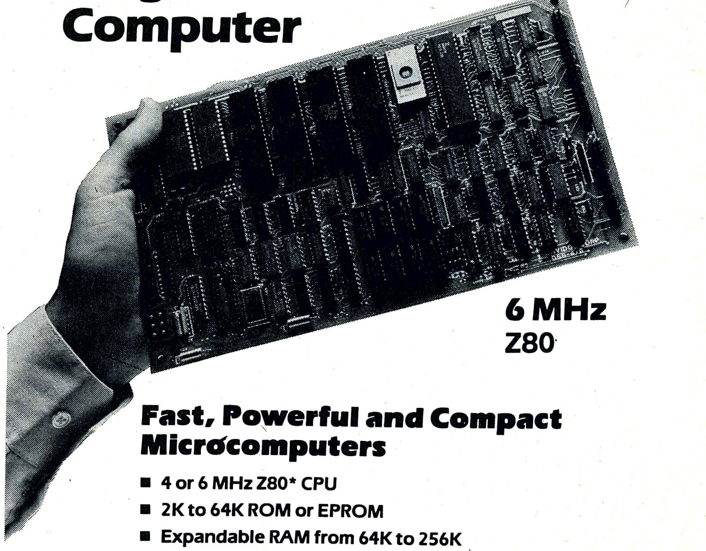

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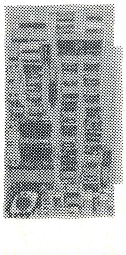

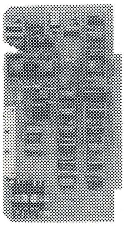

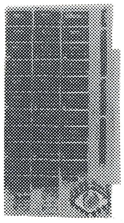

MCP/SCC-6 Z80B 6MHz S-100 CPU. Operates at 2,4 or 6MHz. Includes two serial ports using 8251 usarts with selectable baud rates from 50 to 19.2k, three programmable 8 bit parallel ports, 1k onboard static ram, and 2716 Eprom with monitor. Onboard ram and eprom can be disabled on system boot. ASSEMBLED AND TESTED PRICE — $225.00

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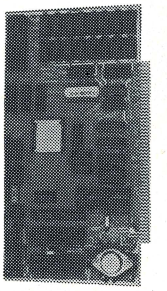

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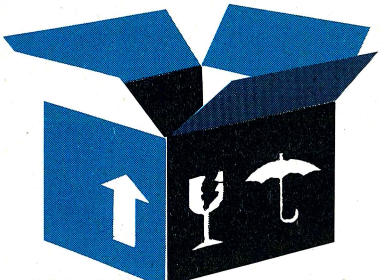

New Products

What's new: a quick roundup of recent innovations and improvements

Data Sentry modem

Data Sentry is an intelligent modem that can prevent data theft on personal, mini and mainframe computer systems by means of a call-up, call-back password sequence that requests a caller's phone number, then hangs up and searches its lists of authorized numbers. If the caller's number is authorized, Data Sentry dials the caller back and requests a password; if the correct password is not given within three tries, Data Sentry will not return further calls from that phone number.

Data Sentry also creates an audit trail of user passwords and phone numbers, whether calls were successful or not. A lower security mode lets users program Data Sentry to call back any number from which it gets the correct password. Using its Remot-ON option, Data Sentry can also turn a computer on or off.

Data Sentry performs 300- or 1200-baud, full-duplex, asynchronous operations with autospeed and autoparity selection. It displays call progress status on the terminal, showing dialing, ringing, busy, check line and dead line. Tone and rotary pulse dialing are auto-selected, so Data Sentry can be used with all long distance services.

Six programmable directories are also available: these store phone numbers 10-32 characters in length that Data Sentry will not call back when it is in security mode. Terminal interface is a standard RS-232C cable. The telephone interface is a single telephone number drop with an RJ-11C connection. A battery backup protects menus and tables in memory during moves and power failures, and there is a forced answer/originate feature for use with leased lines. Priced at $895, Data Sentry is available from: **Lockheed-Georgia Company,** *86 S. Cobb Dr., Marietta, CA 30063, (404) 424-2701.*

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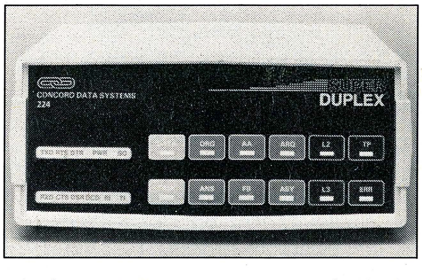
Full duplex autodial modem

The CDS 224 Superduplex is a full duplex modem with a statistical multiplexor, ARQ error-correction, and autodial features, capable of both interactive as well as batch traffic. The Superduplex connects multiple asynchronous devices to a standard 2-wire switched telephone line for 2400 or 1200 bps transmission and is compatible with international CCITT recommendations.

The statistical multiplexor has three RS-232 ports that can be configured by keyboard for baud rate, character format and flow control. Each port supports 14 asynchronous speeds ranging from 50 to 9600 bps. Baud rate may be set by switches or an autobaud can be invoked that automatically matches port speed to that of the remote device. The Superduplex has two types of flow-control and an adaptive prioritizing technique which ensures that interactive traffic has priority over batch traffic. Its error-recovery feature utilizes a bit-synchronous protocol to provide end-to-end error-free transmission and full data transparency to permit the transfer of binary files.

The automatic dialing feature supports both Touch tone and rotary (pulse) dialing systems, and can be controled via keyboard or software commands, enabling the storage of telephone numbers and automatic redialing. Other operating modes include automatic answer, which connects the modem to the telephone line in response to a call from a remote modem, as well as originate and/or manual answer modes. The Superduplex has software-implemented advanced signal processing techniques that reduce the number of internal components and lower power consumption. It also has an automatic adaptive equalizer that compensates for telephone line interference. Integral diagnostics provide rapid fault isolation and include Loop 2 (Digital Self Test) and Loop 3 (Analog Self Test), as well as an internal test pattern generator and checker. Additional diagnostics aid in isolating problems within the modem or multiplexor portions of the unit. The Superduplex is available in either tabletop or rackmount configuration. The tabletop version is powered by an external AC power pack. The rackmount configuration houses up to five modems in 8.75″ height and utilizes standard ANSI configuration 19″ rack width. An FCC standard modular jack connects the Superduplex to the dial network, and a second jack is provided for optional connection of any FCC-approved handset (type 500 rotary dial, 2500 Touch Tone). Priced at $1,695, the Superduplex is available from: **Concord Data Systems, Inc.,** *303 Bear Hill Rd., Waltham, MA 02145, (617) 890-1394.*



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Q/C

For only $95, Q/C is a ready-to-use C compiler for CP/M. You get complete source code for the compiler and over 75 library functions. Q/C is upward compatible with UNIX Version 7 C, but doesn't support long integers, float, parameterized #defines, and bit fields.

- Full source code for compiler and library.
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- Z80 version takes advantage of Z80 instructions.
- Excellent support for assembly language and ROMs.
- Q/C is standard. Good portability to UNIX.

Version 3.2 of Q/C has many new features: structure initialization, faster runtime routines, faster compilation, and improved ROM support. Yes, Q/C has casts, typedef, sizeof, and function typing. The *Q/C User's Manual* is available for $20 (applies toward purchase). VISA and MasterCard welcome.

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NEW PRODUCTS

Continued from page 128

modem interfaces with almost every personal computer available, including Apple, Atari, Commodore, DEC, Eagle, Epson, Franklin, IBM, KayPro, NEC, Radio Shack, Texas Instruments, and Zenith. The Volksmodem has a 300-baud data rate, plug compatibility with any wall phone jack, a full/half-duplex switch, automatic selection originate/answer mode, a voice/data switch for phone use without modem disconnection, and advanced CMOS low-power circuitry. It also has standard 9-volt battery power and a battery life of approximately 2 years.

Five adapter cables, priced at $12.95 each, interface with RS-232 DCE male, RS-232 DTE male, RS-232 DCE female, as well as with the TRS 80 color computer and the Atari. The Volksmodem is available for $79.95 and is backed by a lifetime limited warranty. Included with the price is a free subscription to THE SOURCE. **Anchor Automation, Inc.,** *6913 Valjean Ave., Van Nuys, CA 91406, (818) 997-6493.*

CIRCLE 317 ON READER SERVICE CARD

PC-Handler creates PC network

The PC-Handler links up to four PCs into a shared-resource network. It plugs into the IBM PC expansion slot and acts as a data control center to allow additional PCs to share data and peripherals. Because the PC-Handler has an on-board CPU and firmware, it handles all housekeeping chores independent of the host IBM PC. The PC-Handler will work on all IBM PC-compatibles, the PC*jr*, PC Portable and Apple II.

The PC-Handler also has many of the characteristics of multifunction expansion boards: it offers two serial ports, four IBM-compatible parallel ports, a clock and calendar, spooling capability and disk emulation. It comes with 64K, expandable up to 512K or to 2MB. The print spooling capability of the PC-Handler allows printing or plotting to occur off line at any prespecified time. The PC-Handler determines the selection of the printer port, the number of copies, and the priority of any print file management functions.

A resident RAM disk emulation program allows programs to run exceptionally fast by devoting a portion of memory to emulate the IBM PC floppy disk drive. Priced at $795, the PC-Handler is available from: **Synetix, Inc.,** *10635 NE 38th Pl., Kirkland, WA 98033; (206) 828-4884.*

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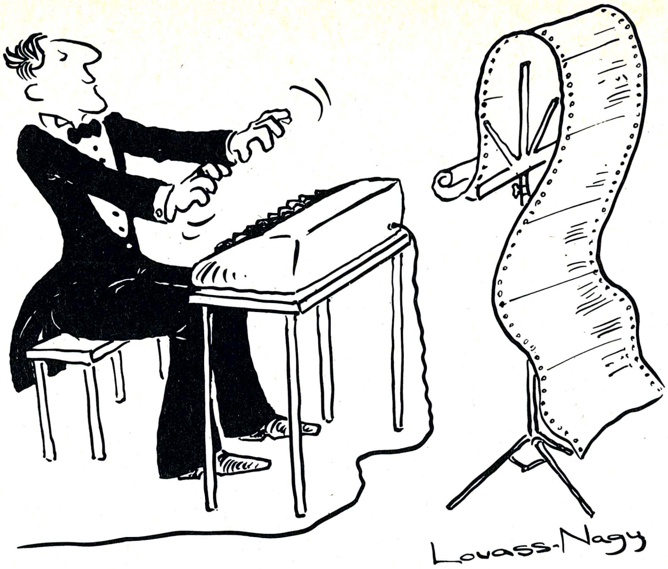

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<tr><td>XASMZ80</td><td>Z-80</td><td rowspan="2"></td><td rowspan="10">$250.00 each</td></tr>
<tr><td>XASM85</td><td>8085</td></tr>
<tr><td>XASM05</td><td>6805</td><td rowspan="10">$200.00 each</td></tr>
<tr><td>XASM09</td><td>6809</td></tr>
<tr><td>XASM18</td><td>1802</td></tr>
<tr><td>XASM48</td><td>8048/8041</td></tr>
<tr><td>XASM51</td><td>8051</td></tr>
<tr><td>XASM65</td><td>6502</td></tr>
<tr><td>XASM68</td><td>6800/01</td></tr>
<tr><td>XASMZ8</td><td>Z8</td></tr>
<tr><td>XASMF8</td><td>F8/3870</td><td rowspan="2">$300.00 each</td></tr>
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<tr><td>XASM75</td><td>NEC 7500</td><td colspan="2">$500.00</td></tr>
<tr><td colspan="2">Coming soon: XASM68K...68000</td><td colspan="2"></td></tr>
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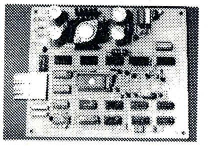

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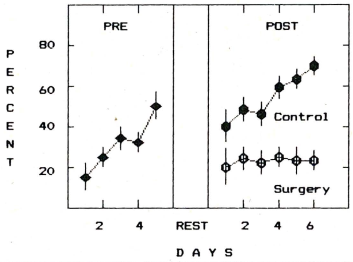

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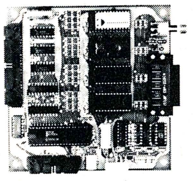

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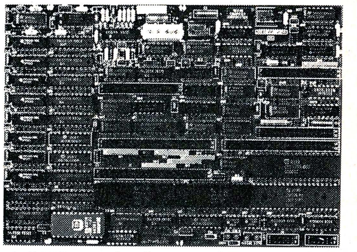

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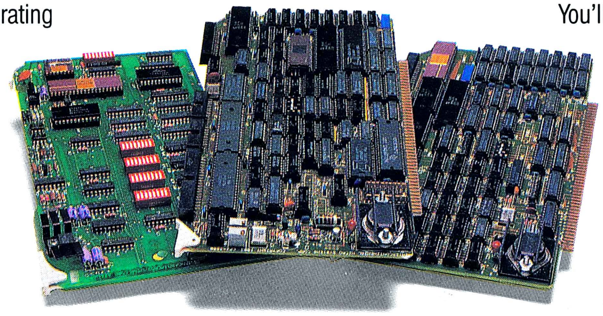

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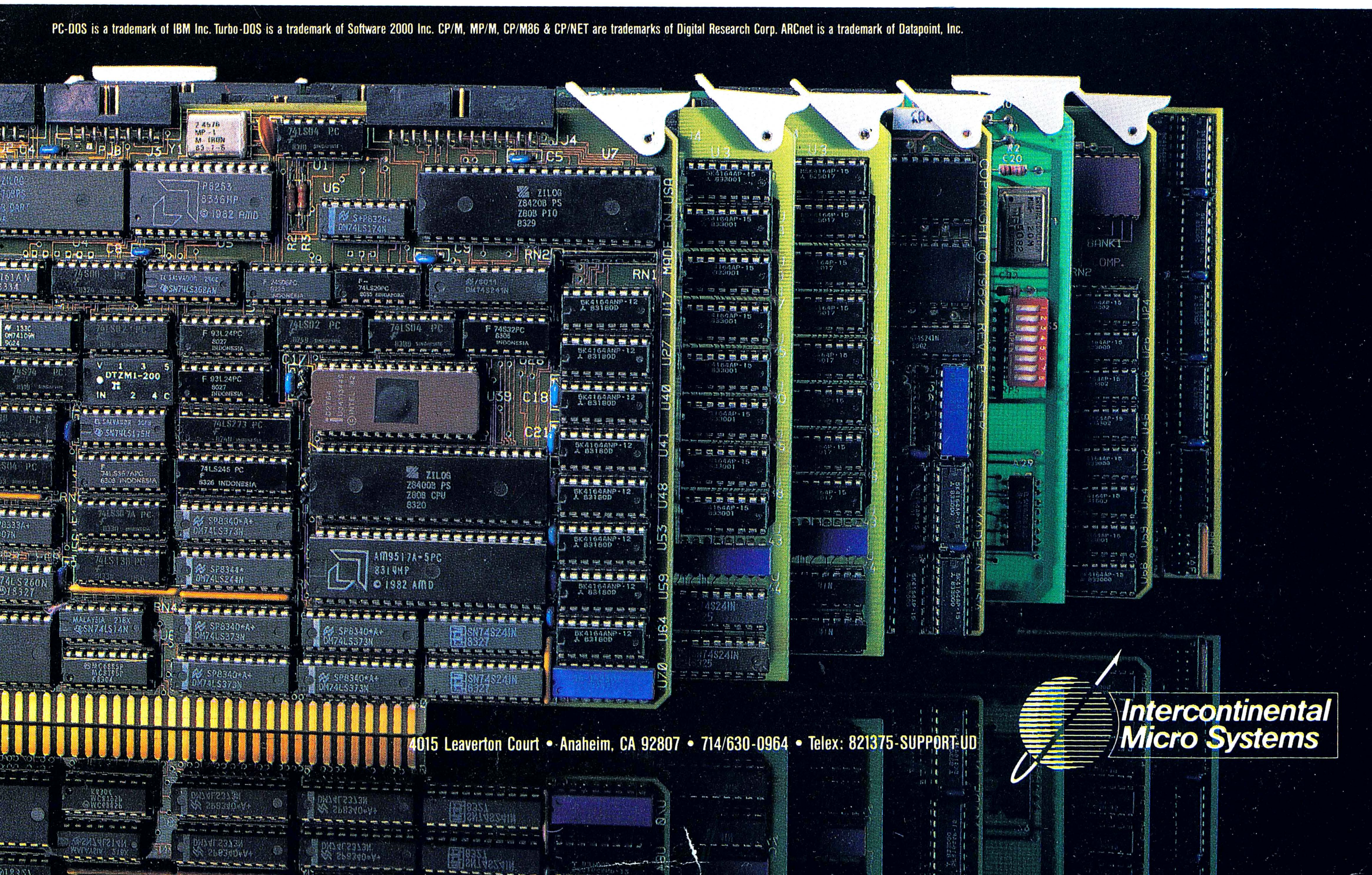

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